VOLUME 38
NUMBER 9

SEPTEMBER, 1951

# plating

**REPORTS FROM A. E. S. CONVENTION**

See Contents Page 925

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**JETAL** meets U. S. Army spec. 57-O-3C for Type III Class A Finish

**JETAL** provides maximum resistance to wear and penetration

**JETAL** will not chip, peel, crack, crumble or dust off

**JETAL** makes no change in the dimensions of the work-piece

**JETAL** is an ideal base for lacquer, enamel or japan

**JETAL** may be resistance or spot welded

**JETAL** resists corrosion

**JETAL** is quickly applied by immersion —no current required

JETAL gives an attractive black finish—subdued or lustrous as specified. The process is a simple immersion method for blackening ferrous metals by oxidation. Even with unskilled labor it can be applied in five minutes for ordinary requirements. The low cost of materials, together with the simplicity of the process, make this an exceedingly economical method.

Jetal provides an excellent base for lacquers and other organic coatings, improving adhesion and retarding undercoat corrosion. It is widely used on aircraft and automobile parts, axles, bearings, bolts, cutting tools, engines, firearms, instruments, propellers, radio parts, cartridges, shells and a vast number of other items.

FREDERICK **GUMM** *Chemical Company Inc.*

538 FOREST STREET, KEARNY, N.J.

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# Enthone metal strippers

*no attack on the base metal*

*strip in barrels, baskets or bulk... without electric current*

**metal stripper A** A new alkaline compound that chemically dissolves nickel, copper, zinc, cadmium and silver from steel without etching or attack. The steel is clean and ready for refinishing. Suitable for rack, basket or barrel stripping. Removes excess silver solder from steel rapidly. Patents pending.

**metal stripper N-165S** A compound added to acid solutions to promote rapid stripping of nickel, tin and lead coatings from copper alloys. No electric current is required.

**WRITE FOR LIST OF SIXTY PRODUCTS AND PROCEDURES FOR METAL FINISHING**

**ENTHONE**
INCORPORATED

**442 ELM STREET • NEW HAVEN, CONN.**

# USE "RELIANCE" PRODUCTS FOR

## ECONOMY : EFFICIENCY : DEPENDABILITY

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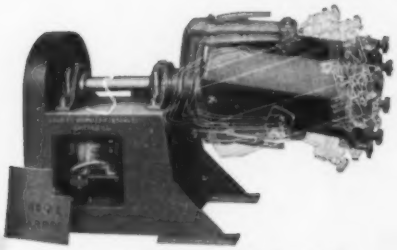
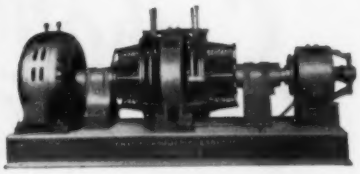
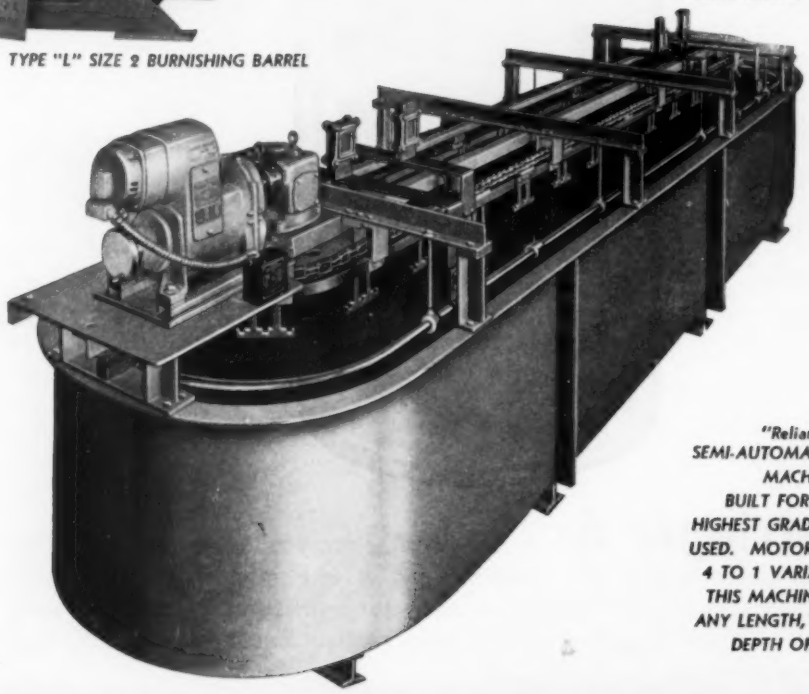


TYPE "L" SIZE 2 BURNISHING BARREL



3000 AMP. 6 VOLT GENERATOR SET



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SEMI-AUTOMATIC PLATING MACHINE
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HIGHEST GRADE MATERIAL USED. MOTOR ¾ to 1 HP
4 TO 1 VARIABLE SPEED.
THIS MACHINE IS BUILT ANY LENGTH, WIDTH AND DEPTH OF TANK.

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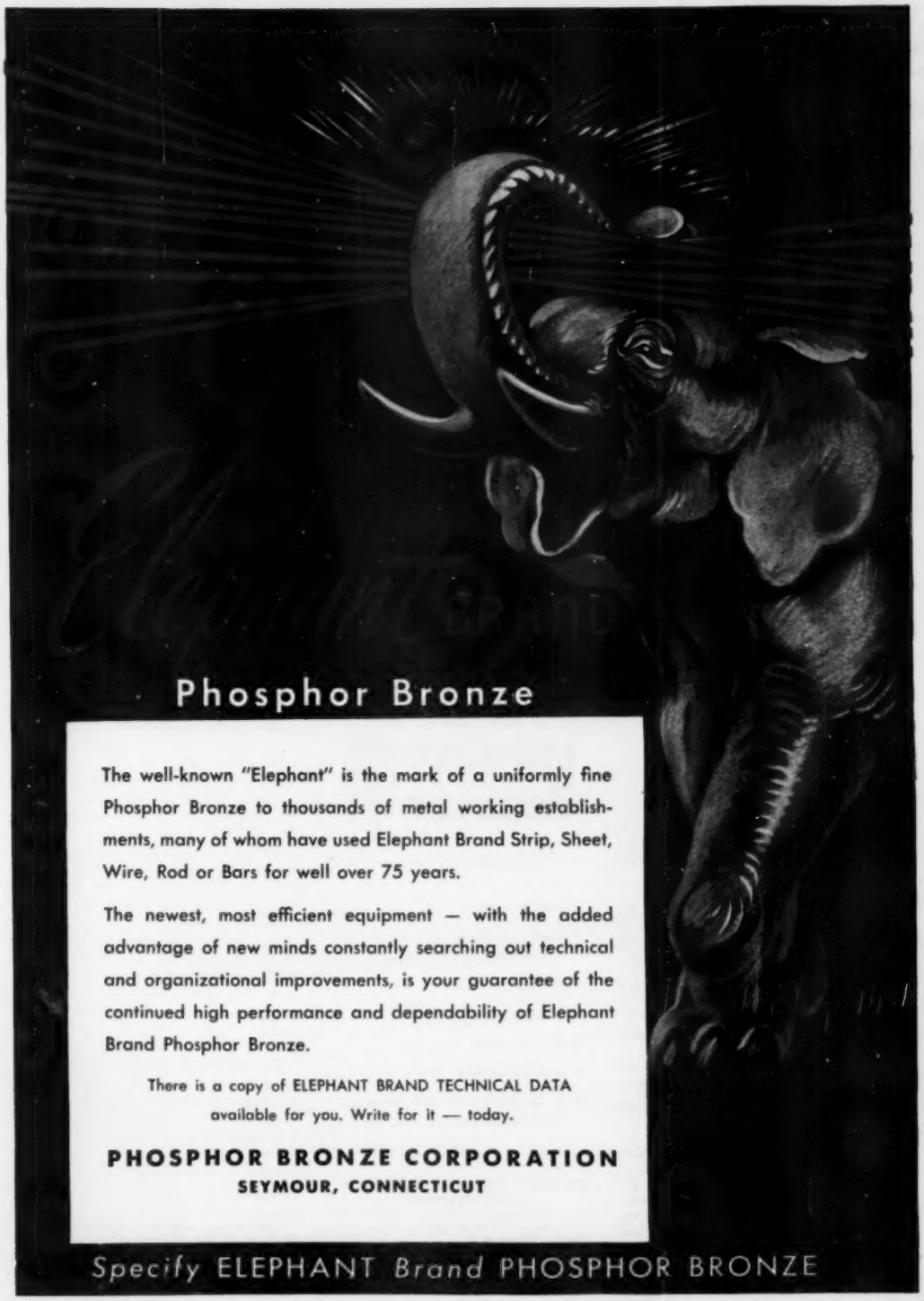

# Phosphor Bronze

The well-known "Elephant" is the mark of a uniformly fine Phosphor Bronze to thousands of metal working establishments, many of whom have used Elephant Brand Strip, Sheet, Wire, Rod or Bars for well over 75 years.

The newest, most efficient equipment — with the added advantage of new minds constantly searching out technical and organizational improvements, is your guarantee of the continued high performance and dependability of Elephant Brand Phosphor Bronze.

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**SEYMOUR, CONNECTICUT**

Specify ELEPHANT *Brand* PHOSPHOR BRONZE

# Wyandotte Nordall

This New **Emulsion Cleaner**

Gives You Extra Advantages—

# FREE!

Wyandotte Nordall is an emulsion cleaner so outstanding in performance that it has many unique advantages. Yet it compares in cost to low-priced cleaners now on the market. This means that you can switch to Nordall and get the benefits of many of these advantages — at no extra cost!

Wyandotte Nordall is designed for emulsion cleaning of metal parts in pressure spray washers. It can also be used for immersion or soak type cleaning or for cold cleaning of large metal and concrete equipment. Ask your Wyandotte Representative to demonstrate the advantages listed at right.

P.S. — Do you have a conversion or civilian production cleaning problem of any type? Write Wyandotte for free technical information and service.

**NORDALL**

- *Gives maximum detergency at low cost*
- *Inhibits rust*
- *Contains special solvents which reduce evaporation losses*
- *Has sustained emulsion life*
- *Is noncorrosive*
- *Does not foam*
- *Is always uniform*
- *Is nonflammable and nontoxic under normal use.*

**THE WYANDOTTE LINE**—products for burnishing and burring, vat, electro, steam gun, washing machine and emulsion cleaning, paint stripping, acid pickling, related surface treatments and spray-booth compounds. An all-purpose floor absorbent: Zorball. In fact, specialized products for every cleaning need.

**WYANDOTTE CHEMICALS CORPORATION**
WYANDOTTE, MICHIGAN
*Service Representatives in 88 Cities*

Wyandotte
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# *Industry News*

**The Thermal Syndicate, Ltd.,** has moved its offices and warehouse into a new and spacious building at 14 Bixley Heath, Lynbrook, N. Y., with facilities for larger stocks and better service.

Thermal is the pioneer company in fused quartz and fused silica products manufactured under the trade-mark "Vitreosil".

**Beitzel Scholarship.** Joseph W. Distel of Wyndmoor, Pa., was awarded the first college scholarship provided for sons and daughters of employees of the **Pennsylvania Salt Manufacturing Company** by George B. Beitzel, company president. Mr. Distel, who graduated from Springfield High School, Erdenheim, Pa., with an A average and an outstanding record of school achievement, is the son of Mr. and Mrs. Francis E. Distel of 801 Abington Ave., Wyndmoor. His mother is an employee at Pennsalt's Whitemarsh Research Laboratories.

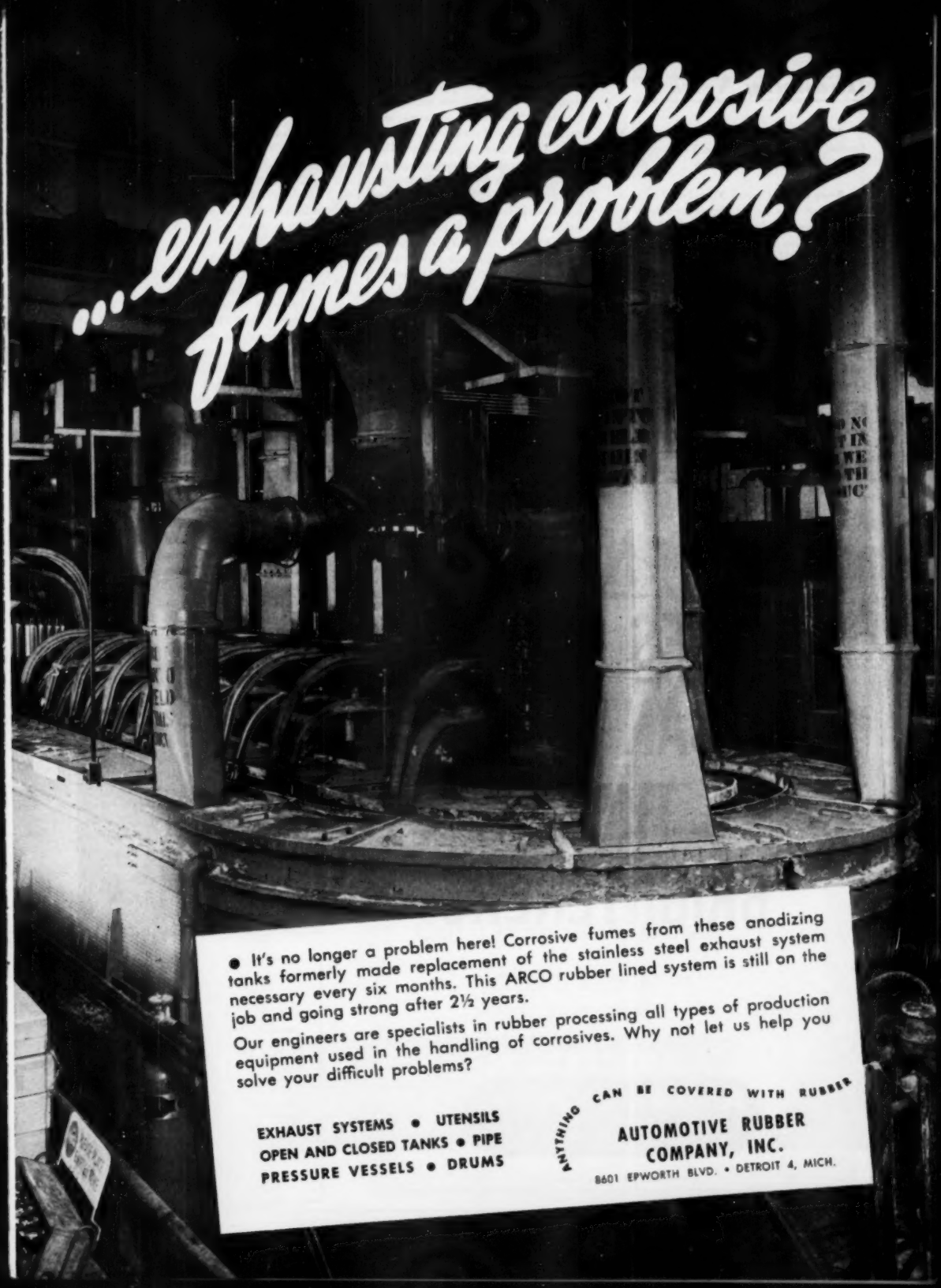
**Production Anodizing of Small Aluminum Parts.** According to Technical Processes Division, Colonial Alloys Company, Philadelphia 29, Pa., a new technique of production anodizing of small parts, either plain or colored, has been worked out to eliminate most of the objections to rack or basket anodizing—high rack cost, rack maintenance cost and racking-labor cost, or, in basket anodizing, objectionable touch-marks, nonuniform coats and a high percentage of rejects especially in color work.

As an example of production speed, a small colored-aluminum government-specification part has been timed to run 200,000 parts per hour per unit. Typical small parts are rivets, eyelets, grommets, ferrules, screws, bolts, nuts, sleeves, barrels, caps, washers, nails, pins, fasteners, fittings, special screw machine parts, stampings and forgings.

The advanced delivery schedules and lower costs at the Philadelphia plant over typical rack-mounted anodizing usually more than offsets any freight and shipping costs, even from distant points, it is said.

**Giering Metal Finishing Company,** specializing in baked enameling, plating, anodizing, lacquering, woodgraining and industrial hard chromium, announces the opening of a plant at 194 Main St., East Haven, Conn. New modern equipment capable of producing the finest in metal finishing has been installed.

Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Subscriptions: Domestic and Canada, $4.00 for 1 year, $7.00 for 2 years 50c per copy; Foreign, $8.00 per year, $1.00 per copy.




● It's no longer a problem here! Corrosive fumes from these anodizing tanks formerly made replacement of the stainless steel exhaust system necessary every six months. This ARCO rubber lined system is still on the job and going strong after 2½ years.

Our engineers are specialists in rubber processing all types of production equipment used in the handling of corrosives. Why not let us help you solve your difficult problems?

**EXHAUST SYSTEMS • UTENSILS**
**OPEN AND CLOSED TANKS • PIPE**
**PRESSURE VESSELS • DRUMS**

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**AUTOMOTIVE RUBBER COMPANY, INC.**

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## *Industry News*

Mr. Giering has been associated with metal finishing for the past sixteen years in the Hamden, Conn., area.

**Uses of Platinum Metals.** The present large uses for platinum metals in industry were reviewed by Dr. Edmund M. Wise in the Sixth Leroy Egerton Westman Memorial Lecture at the 34th Annual Conference of The Chemical Institute of Canada on June 18.

Dr. Wise pointed out that all nitric acid, most of the glass fibre and the xanthate rayon fibre are produced with the aid of platinum or platinum alloys. All hydrogen peroxide is produced by electrochemical processes involving platinum anodes and some of the recent advances in photographic lenses have been made possible by using platinum equipment to produce the special types of glass required. The platinum metals are used in the production of vitamins, dihydrostreptomycin and cortisone.

On the subject of palladium, Dr. Wise stated that its major uses, aside from jewelry and dental alloys, is for electrical contacts in telephones, and further improvements in service through the use of automatic exchange is largely made possible by the reliability of this contact material, as relays are now expected to operate over one billion times without failure.

He mentioned briefly a new development of great importance to the platinum industry, the new Platforming Process which utilizes a platinum catalyst for improving the anti-knock value of straight-run gasoline. Substantial quantities will be required for the installation of large plants.

Dr. Wise is in charge of the Platinum Metals and Electronics Section of the Development and Research Division of The International Nickel Company and has been associated with that organization since 1927.

**The 24th International Congress for Industrial Chemistry and 1st Chemical Exhibition,** sponsored by Societe de Chimie Industrielle, 28 Rue Saint-Dominique, Paris 7, France, will be held on November 25–December, 1951 and November 22–December 2, respectively, in Paris, in connection with the 2000-year celebration of that city.

Papers will be presented before 19 sections, among them Section 3 on Water Treatment, Section 4 on Industrial Hygiene, and Section 7 on Electrochemistry. The Exhibition will cover laboratory materiel and industrial control equipment. Papers and exhibits are invited, and visitors are welcome.

**Rack, Tank Coating Patent License.** U. S. Patent No. 2,550,232, issued April 24, 1951, to John W. Donnell and Kenneth Tator and assigned to Industrial Lining Engineers, Inc., 3527 Smallman St., Pittsburgh 1, Pa., is entitled "Method of Coating Metallic Articles with Vinyl Resin Dispersions" and embodies seven claims.

It is contemplated that a licensing arrangement on reasonable terms will be made available to interested parties such as coaters of plating racks, tanks, and other metallic articles used in the plating, chemical, and other industries.

**Solvent Recovery Service in Louisville.** The Kentucky Color & Chemical Company, 600 N. 34th St., Louisville 12, Ky., announces a solvent-recovery service for users of finishing materials within a radius of 200 miles of Louisville. The company has been in the solvent recovery business for over 15 years and has handled a heavy gallonage of solvent, mostly from paint manufacturers and furniture finishers.

**Spray Painting Classes** at the School of Spray Painting operated by the **De Vilbiss Company,** Toledo 1, Ohio, are


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as well as a trial in your own plant!

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Manufacturers of Iridite Finishes
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**Cut Overhead Costs**

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***about your needs!***

**WILLIAMSVILLE BUFF DIVISION**
The Bullard Clark Company
DANIELSON, CONNECTICUT

## Industry News

again being offered, at no charge for instruction, beginning July 16, August 13, September 17, October 15, and December 10. Users of DeVilbiss equipment may make application now to enroll their spray operators, shop superintendents and service managers for any of the one-week courses scheduled. Enrollees pay only for meals and lodging while attending the school.

**Instrumentation Course.** On September 17, the Brown Instruments Division, Minneapolis Honeywell Regulator Company, will start the first semester of its 1951–1952 courses in industrial-instrument maintenance and repair. This course, conducted annually for more than a decade at the Brown School of Instrumentation in Philadelphia, will continue to December. That and the second semester, starting in January, will include a 13-weeks comprehensive course concurrently with the shorter classes. As in the past, these courses will be for the benefit of customer and Brown personnel.

**Plating Engineering Company, Milwaukee, Wis.,** has announced removal of its plant to 1928 S. 62nd St., a modernized concrete and steel building. New and enlarged equipment has been installed for heavy nickel, chromium and copper plating; iron, lead, and lead-tin-alloy plating; and electropolishing of aluminum and stainless steel. Phil J. Ritzenthaler is president of the company.

**The Plant Maintenance Show,** newest of the giant industrial expositions, will next be held at Convention Hall, Philadelphia, January 14–17, 1952.

The exposition, held for the first two years in Cleveland, has been moved to Philadelphia to permit greater attendance from the eastern industrial area. The second show attracted visitors from 39 states and more than 10 foreign countries. One hundred and fifty-six firms already have contracted for exhibit areas in Philadelphia.

Concurrently with the show, the **Plant Maintenance Conference** also will be held. L. C. Morrow, consulting editor, Factory Management and Maintenance, will serve as chairman. The last conference drew audiences of 1,700 at a single session, one of the best attended annual technical conferences in the country.

Advance registration cards and hotel information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York, N. Y.


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FOR ALL JOBS

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FOR ALL METALS OR COMBINATION OF METALS

ONE PRICE
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Blakeslee SOLVENT VAPOR DEGREASERS are more economical more efficient—USE LESS SOLVENT

NIAGARA Metal Parts Washers for use with cleaning compounds on either batch or production jobs.

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BLACOSOLV contains the finest and toughest stabilizers to prevent solvent breakdown. You need not pay premium prices for special solvents for different metals. Blacosolv can be used over and over, under the most rigorous conditions, without impairing its high qualities.

**G. S. BLAKESLEE & CO.**

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New York, N. Y. Toronto, Ont.



METAL CLEANING RESEARCH CHEMIST

Capable man wanted to carry out metal cleaning research. Background of physical chemistry, metallurgy or chemical engineering. Experience in metal cleaning or electroplating desirable. Nationally known firm with laboratory in central New York. Please send qualifications and snapshot, and indicate salary expected.
*Reply to:*
P-951-B, PLATING
P. O. Box 168, Jenkintown, Pa.

WANTED

Chemical Engineer. An established company is desirous of obtaining the services of a chemical engineer who has had plating experience to develop in the sales field in such category. Wonderful opportunity for right man. Wisconsin area. Please state qualifications and references. All replies will be held strictly confidential.
*Reply to:*
P-951-C, PLATING
P. O. Box 168, Jenkintown, Pa.

Position open in solution control for man familiar with complete analysis and maintenance of nickel-chrome full automatic. Plant located in North Central Pennsylvania. Address reply with qualifications and salary desired to
P-951-D, PLATING
P. O. Box 168, Jenkintown, Pa.

METAL SURFACE TREATMENT

Chemist or Chemical Engineer: Productive laboratory worker with sound practical and technical background in phosphating, cleaning, and paint-bonding. Permanent position with advancement. Philadelphia suburban location.
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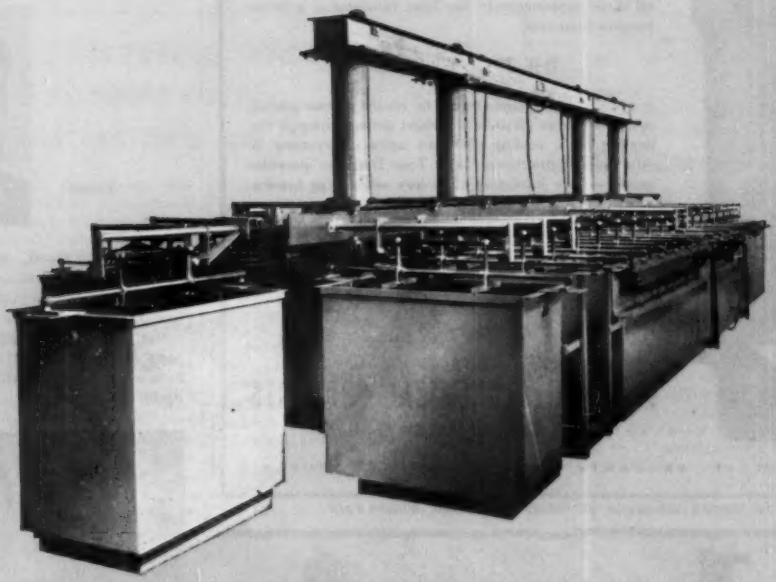
# CROWN TYPE "B" AUTOMATIC



## *you'll be agreeably surprised . . .*

- **At the high production**
- **At the low cost**
- **At the high quality**
- **At the low rejections**

Whether your plating requirements are for high production of small parts or moderate production of large parts, there is a Crown Type "B" machine that will automatically travel your work through the entire treatment cycle — on schedule.

***Write us details of your treatment cycle and production requirements for further information***

**CROWN RHEOSTAT AND SUPPLY COMPANY**

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The True Insulator will give you more safety than before with the same standard of insulation as always. Wire braid hose on the ¾" and 1" sizes insures absolute freedom from failure. The ½" size has been completely redesigned to give higher quality with longer life. With all these improvements the True Insulator is a better bargain than ever.

### THE TRUE INSULATOR

is specifically manufactured to insulate your plating operations from grounds and short circuits through the heating coils, cooling coils, air agitation systems or other pipe connections. The True Insulator provides more positive insulation than any other type known.

*Available in following sizes*

½ inch.....$7.00 per pair
¾ inch.....$7.50 per pair
1 inch.....$8.50 per pair

*Quantity Discounts*

**TRUE BRITE CHEMICAL PRODUCTS**

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# chromic acid

99.75% PURE

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## *Personals*

**Michael C. Tamas** has been appointed Connecticut representative of The Roberts Rouge Company, Stratford, Conn. He is a graduate of Pratt Institute and a specialist in machine design.

Tamas

**James A. Dodd,** newly appointed Michigan representative, was for several years Executive Vice-President of the Detroit Chemical Specialties Company and recently formed the Dodd Abrasives Company in Detroit at 3215 Bellevue Ave., from where sales and delivery for Roberts Rouge will be handled.

Dodd

Holcomb

**Miles K. Holcomb,** new New York representative, was formerly with the United Aircraft Company. He has been in charge of customer orders at the Stratford factory for several years and will continue to work out of that office.

**L. E. Menns** has been appointed Pacific Coast Sales Manager for Bridgeport Brass Company. Previously Los Angeles District Manager, he will be in charge of the San Francisco District Office and Warehouse as well, and will be responsible for the sale of all Bridgeport Products on the Pacific Coast.

**Edison C. Sickman,** formerly Sales Coordinator, has been appointed General Sales Manager of Atlas Mineral Products Company, Mertztown, Pa. **Donald F. Deakin** and **Gerald F. Gilbert, Jr.,** will assist Sickman in sales-department activities. **Earl A. Erich** has been appointed to handle Technical Service activities. **Augustus Boovu,** a graduate of St. Vincent College and formerly with Ciba



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 811.

SEPTEMBER 1951

# PENNSALT CHEMICALS METAL CLEANING DIGEST

**for men interested in Metal Cleaning Economies**

## U. S. STEEL REDUCES NUMBER OF BATHS, CUTS CLEANING COSTS ON GALVANIZING LINE

Early this year the Galvanizing Shop at the Irvin Works of the United States Steel Company faced a tough problem. They were asked to clean strip steel in their own tanks direct from the rolling mill, instead of having it pre-cleaned first on the tin mill's high-speed cleaning lines. This meant a new cleaning set-up . . . unless a special product could be developed for this job.

Pennsalt was called in, and a three-way team went to work on the problem. The Pennsalt fieldman, Pennsalt's Whitemarsh Research Laboratories and men from the Irvin Works pooled their knowledge and set about developing a new cleaning procedure.

This wasn't easy, because the galvanizing shop cleaning tanks hadn't been designed to do a double cleaning job. The first step, therefore, was to develop a special dual-purpose cleaner which would remove *two* types of soil.

Next the problem of cleaner strength was attacked. The new cleaner had to be strong enough to permit the use of the small capacity galvanizing line cleaning tanks, yet flexible enough to meet the multiple cleaning demands. Such a delicate ingredient balance could only be achieved by a *manufacturer* of basic chemicals, like Pennsalt.

Within one month from the date this unique cleaning problem came up, Pennsalt chemists made their recommendation and a test was arranged. They proved to be right on the very first try! Adherence tests proved conclusively that the cleaner was doing its job perfectly. In addition, the finished product came out of the galvanizing shop with more "shine". Rejects due to faulty cleaning were nil. Cleaning costs were significantly reduced and the tin mill cleaning tanks were released for other service.

U. S. Steel and Pennsalt engineers observe results of new Pennsalt-developed cleaning process in galvanizing shop.

## Zinc Die Castings Now Free of "Blisters"

Clean, plate, lacquer, bake . . . that's the cycle used in making radio panels for two of America's leading automobile manufacturers. The panels are made from zinc-base die castings.

But the job platers had a tough time avoiding blisters after baking, caused by minute dirt particles or breaks on improperly cleaned parts.

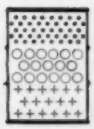
Then Pennsalt Cleaner Z-54 was tried. This cleaner is especially compounded for zinc-base die casting cleaning. Result—perfect, for all practical purposes. Average 0.1% cleaning rejects, and commendation from the automobile manufacturers for this highest quality work!

## *For Your Lab Notebook*

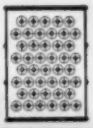
### Why Pennsalt Alkaline Cleaners are Based on Fused Materials

**Pennsalt alkalies for metal cleaners are prepared by an economical patented process that produces a *fused* homogeneous material. Fused alkalies will not segregate in drums—the alkali on the top of the drum is of the same balanced composition as the alkali at the bottom of the drum. Homogeneous composition also means fast, even dissolving of the alkali crystals—no rapid solution of caustic agents while phosphates or silicates drop to the tank bottom and dissolve slowly.**

**These fused alkalies are used as base materials for the various Pennsalt metal cleaners. Thus the user is assured of minimum alkali segregation, along with efficient, balanced bath composition. Pennsalt is a basic producer of metal cleaning alkalies—this means economies in manufacture which are passed on to the user.**



This shows how the various ingredient particles of ordinary cleaners can shift and settle. (Exaggerated for clarity.)



Pennsalt Alkaline Cleaners are based on fused materials . . . ingredients are fused into homogeneous particles, which remain uniform throughout the drum.

MAIL THIS COUPON

Please send more information on cleaning

..... (metal)

prior to ..... (Finishing method) (If)

Name .....

Company .....

Address .....

City ..... Zone .... State .....

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*Progressive Chemistry for Over a Century*

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WIDENER BUILDING • PHILADELPHIA 7, PA.
*Progressive Chemistry for over a Century*

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## PROTECTS ALUMINUM
## ANCHORS THE PAINT FINISH

MEETS GOVERNMENT SPECIFICATIONS

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|---|---|
| MIL-C-5541 | U.S. Navord O.S. 675 |
| MIL-S-5002 | 16E4 (Ships) |
| AN-F-20 | U.S.A. 72-53 (See AN-F-20) |
| AN-C-170 (See MIL-C-5541) | |

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**ALODIZING is an electroless protective surface conversion process for bonding paint to aluminum and protecting the metal.**

**Tough, durable ALODIZED surfaces are obtained easily and rapidly by immersion, brushing, or spraying in a multi-stage power washer.**

**ALODINE amorphous phosphate coatings provide extra paint permanence and extra durability for aluminum parts and products.**

## BRUSH "ALODINE" PROTECTS ALUMINUM IN THE FIELD, SHOP, OR HANGAR

**Brush ALODINE is easily applied in a simple brush-on or flow coat process to large assemblies and surfaces—airplanes, trucks, trailers, boats, housing, building siding, railway cars, bridges, etc.—that are too bulky or too remote to be conveniently treated in tanks or a multi-stage power spray washer. The cleaning and coating chemicals for Brush ALODIZING are shipped in bulk or in the convenient Brush ALODINE Chemical Kit No. 1. This Kit contains enough chemicals to treat about 1,000 square feet of surface and is an ideal package for use at airfields of commercial airlines or of the Armed Services anywhere.**

Pioneering Research and Development Since 1914

**AMERICAN CHEMICAL PAINT COMPANY**

**AMBLER, PA.**

*Manufacturers of Metallurgical, Agricultural and Pharmaceutical Chemicals*


## *Personals*

Products Company, has joined the company as a sales trainee. **George Gabriel,** Engineering Coordinator, has assumed the additional duties of Plant Manager, and **George Kanelis** has been promoted to Assistant Plant Manager along with **Raymond Trollinger** who became Plant Superintendent.

**R. J. Stell,** Director of the Technical Development Department of The Diversey Corporation, Chicago, since 1948, has been named Assistant to General Sales Manager W. E. Noyes. One of his first duties will be to expand Diversey sales-service of cleaning compounds to the metal industries.

Stell

**Frederick B. Hermann,** Assistant Director of the Technical Development Department, succeeds Stell as Director and **Donald V. Hannibal** is the new Assistant Director.

Hermann Hannibal

Stell began at Diversey as an engineer in the Technical Development Department in 1946. Before long he was named assistant director and in 1948 director of the department. He was earlier a development chemist for duPont and during the war worked at the University of Chicago on chemical warfare.

Hermann, a graduate of the University of Chicago in chemistry, joined Diversey in November, 1947, as an engineer in the Technical Development Department.

Hannibal also started with Diversey in 1947, beginning as a chemist in the Diversey Research Laboratories and later heading analytical control and service. He was graduated from Northwestern University in chemical engineering.

# Flash

*Announcing*

# Lea Copper-Glo

## Something New in Bright High Speed Copper Plating

The Ronal Bright Copper Process* using Lea Copper-Glo is the answer to the platers' prayers because it answers the problem of extreme nickel shortages.

Lea Copper-Glo makes it practicable to plate properly prefinished steel and die-castings *directly* with chromium without any intermediate buffing operation. It makes it possible for you to forget your nickel worries.

**The user of Lea Copper-Glo enjoys numerous advantages as for example:**

**OPERATING**

- **Brilliant ductile deposits**
- **High current density with 100% efficiency**
- **Exceptional throwing power**
- **No wetting agents required**
- **Direct, interrupted or periodic reverse current**

**COST SAVINGS**

- **Reduces tank plating time due to high speed operation. (Hull cell bright current density range 10-60 amp./ft.²)**
- **Reduces rejects whether followed by bright nickel or otherwise; since it contains no wetting agents**
- **Reduces brightener costs to a few cents/100 gallons of plating solution per day**

The Ronal Bright Copper Process using Lea Copper-Glo can be fitted into your plant operating cycle. Regular cyanide or Rochelle Copper baths can be readily converted to obtain these advantages.

**Ronal Bright Copper Process is a development of Ronal Chemicals, Brooklyn, New York, for which process patents are pending.*

Burring, Buffing and Polishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions

**THE LEA MANUFACTURING CO.**
**16 Cherry Avenue, Waterbury 20, Conn.**
**LEA MFG. COMPANY OF CANADA, LTD.**
**370 Victoria Street, Toronto 2, Canada**



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 814.

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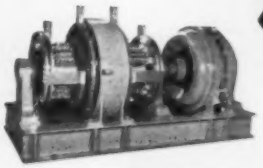

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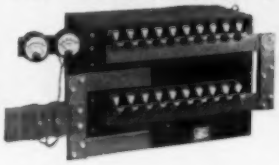
for Electroplating, Anodizing, Electrocleaning, Electropolishing



TANK RHEOSTATS
- REVERSING SWITCHES
- TONG TEST AMMETERS

*Write for Descriptive Bulletins*

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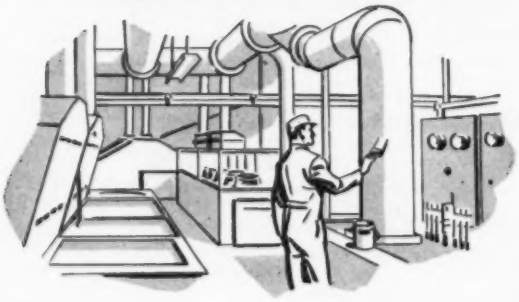
How to have a better-looking plant and SAVE on maintenance



UCILON Protective Coating Systems stop corrosives —give life-saving protection to metal, concrete, wood!

Of course you can have an attractive plating department and cut costs too. For when you apply Ucilon Coating Systems, you get a job that stands up despite the strong corrosives and excessive moisture.

One well-known company, for instance, had its entire plating department protected with Ucilon coatings—including tanks, walls, concrete floor, ducts. These coatings have resisted attack for better than *two years*—and they're good for much more!

Ucilon Coating Systems resist continuous contact with acids, alkalies, water, cleaners, as well as fumes and splashing from plating baths. Spray or brush them on wherever corrosion is costing you money. Ucilon coatings are helping hundreds of concerns to maintain equipment in tip-top condition while reducing frequency and expense of painting. To learn how they do it, send today for new, concise, 4-page bulletin on corrosion control with Ucilon Coating Systems.

UCILON* Protective Coatings

UNICHROME products of UNITED CHROMIUM, INCORPORATED

100 East 42nd Street, N. Y. 17, N. Y. *Trade-Mark

Detroit 20, Mich. • Waterbury 20, Conn. • Chicago 4, Ill. • Los Angeles 13, Calif.

In Canada: United Chromium Limited, Toronto, Ont.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 816.

## *Personals*

**Richard E. Masters** has been appointed General Manager of The McAleer Manufacturing Division of Higbie Manufacturing Company, Rochester, Mich. Since he started with McAleer in 1942, his work has included research, manufacturing, and sales engineering in connection with the company's line of polishing and finishing compounds.

**E. S. Porter** now handles industrial and commercial cleaning-compound sales in Northern Ohio for The Man-Gill Chemical Company, Cleveland, Ohio. He attended Penn and Cleveland Colleges, where his studies included business administration, sales and accounting. He has spent the past fifteen years in industrial and sales fields, having been with the Lincoln Electric Company in production control for ten years and with the Carter Hotel in sales and auditing before opening his own sales agency.

Porter

**William Young** has been appointed District Sales Manager for the Cincinnati and Southern Ohio territory of Wagner Brothers, Inc., Detroit, Mich. Since 1944 he has been associated with The Udylite Corporation, first as an equipment engineer and later as sales representative. During the 15 years prior to that, he held similar positions with Chrysler Corporation in Evansville, Ind.; Great Lakes Steel Company, Detroit; and National Tube Company, Lorain, Ohio.

Young

**Richard S. Walsh** has been appointed Manager of the Induction Motor Sales Division of General Electric's Small and Medium Motor Divisions at Schenectady, N. Y. A native of St. Joseph, Mo., Mr. Walsh was graduated from Notre Dame

# Capillarity test proves ALUNDUM* Abrasive *makes polishing wheels last longer and perform better*

Capillarity, the ability to absorb liquid, is one property of abrasives which largely determines a polishing wheel's strength and resistance to breakdown. When abrasive grain has high capillarity it is held more firmly by the glue on the wheel head — sticks on the wheel until *all* its work is done.

Norton ALUNDUM abrasive is specially treated to raise its capillarity — and to retain this valuable quality — assuring longer lasting, more efficient polishing wheels.

Offering many other advantages for fast, clean polishing, ALUNDUM abrasive grain is available in sizes and with surface treatments for best results on every polishing job. Write for Booklet No. 1340, "*Setting Up Polishing Wheels And Belts*," containing many helpful tips. Norton Company, Worcester 6, Mass. Distributors in all principal cities.

NORTON
ABRASIVES
*Making better products to make other products better*

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

**LOW CAPILLARITY** is shown by the way this abrasive grain sheds water. It will repel glue in the same degree, resulting in insecure adhesion of abrasive to wheel head — and short wheel life.

**HIGH CAPILLARITY** of Norton ALUNDUM abrasive grain soaks up every drop of water. It will soak up glue in the same way, assuring a stronger, longer lasting, faster cutting polishing wheel.

# BRIGHT FINISHING SYSTEM

# SPARKLES

## LIKE CHROME!

***Leading manufacturers approve zinc plate***

***and IRIDITE® Bright***

***to replace conventional chrome plating***

If your problem is finding the right finish to replace conventional chrome plating, follow the lead of prominent manufacturers of all types of products . . . switch to zinc plate and Iridite Bright.

Here's what you get when you use this chromate finishing system to replace conventional chrome plating.

**SPARKLING BRIGHT APPEARANCE**

The zinc plate and Iridite Bright system resembles chrome so closely that visual inspection can scarcely tell the difference! And, the brilliance *lasts*.

**BETTER CORROSION PROTECTION**

Yes, you actually get better protection with zinc plate and Iridite Bright than with chrome plating . . . up to twice the life under accelerated salt spray conditions! And, by applying a clear baking lacquer over the Iridite coating you can increase the abrasion resistance and lasting qualities of this bright finishing system, at the same time making possible a greater salt spray protection.

**LOWER FINISHING COSTS**

One metal, zinc, replaces three so you save material costs and plating time. Iridite Bright goes on in a non-electrolytic chemical dip.

**Write or call today for your copy of our new Technical Bulletin describing all phases of this bright finishing system in detail. Tell us your bright finishing requirements. If possible send sample parts for test processing.**

Iridite is approved under government specifications

**ALLIED RESEARCH PRODUCTS**
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**REPRESENTATIVES IN PRINCIPAL INDUSTRIAL CITIES; West Coast: L. H. BUTCHER COMPANY**
**Manufacturers of Iridite Finishes**
**for Corrosion Resistance and Paint Systems on Non-Ferrous Metals; ARP Plating Chemicals.**


## *Personals*

University. He completed the G-E Test Course for student engineers in 1932, and a year later joined the General Appliance Company, a G-E affiliate. He returned to Schenectady in 1934 to become a member of the Induction Motor Division, was transferred to the company's Detroit office in 1941 as a Motor Specialist, and was made District Motor Specialist at Chicago in 1946. Appointed Assistant Manager of the Induction Motor Sales Division in 1948, Mr. Walsh became Acting Manager of the division in January of this year.

**John A. Silver** has been appointed Director of Sales of American Wheelabrator & Equipment Corporation, Mishawaka, Ind. He was formerly with Lester

Silver

Rich

Andrus

Lenhard

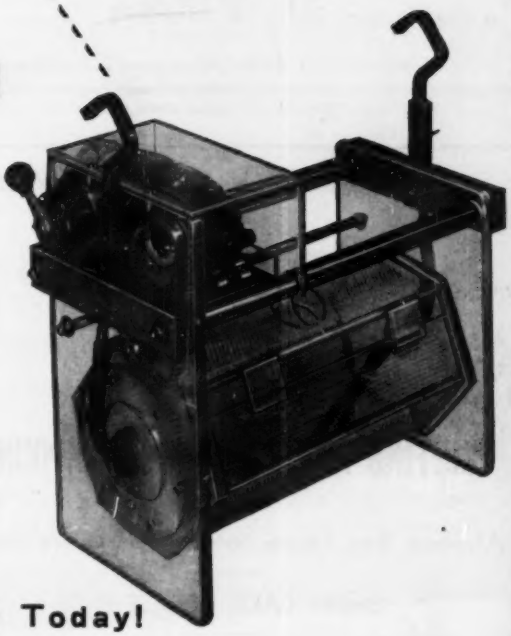
and Silver, management and sales consultants of New York and Philadelphia. **E. B. Rich**, Chicago representative of the Company, has become General Sales Manager. **L. L. Andrus**, formerly Vice-President in Charge of Sales, has been

Deputy

promoted to Vice-President and Executive Head of the Dust & Fume Division. **A. E. Lenhard**, Advertising and Sales

# OUTSTANDING!

## STUTZ *The "Original"* Lucite Ribless Portable Plating Barrel



Revolves through the entire plating cycle without transfer of load from one cylinder to another. Maximum solution temperature 185° F. Made in Two Sizes:

*6" x 12"* ..... *$203.50*
*8" x 18"* ..... *$302.50*

with reversing switch and plug-in cord and with standard perforations of 3/32" or larger.

*Small perforations*
*$8.00 to $28.00 extra.*

As Lucite is non-absorbent, one unit can be used for all your solutions. ORDER TODAY—this is the best investment you can make for your plating room.

• • •

**Don't Delay—Order Today!**

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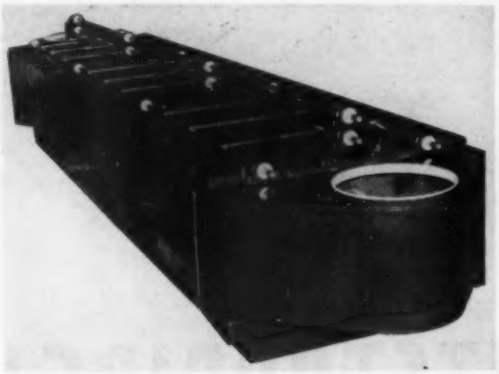
PEERLESS PRODUCTS
1645 CARROLL AVENUE CHICAGO 12, ILL.

**STUTZ—**
*Your Guarantee of Quality!*



**A Better Tank Value by Storts**

Better because: (1) high quality material and workmanship assure long-life utility and satisfaction and (2) Storts engineering aid in design led to improved performance. Put this combination to work on your next tank requirements.

42 STONE STREET — STORTS WELDING COMPANY INCORPORATED — MERIDEN, CONN.

*Manufacturers of Welded Fabrications to Specification*

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**HARRISON'S**

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TAILOR-MADE
**BUFFING AND POLISHING COMPOUNDS**
for
Aluminum, Brass, Copper, Stainless Steel, Carbon Steel, etc.

EMERY CAKE, GREASE STICK

CEMENT AND THINNER
for setting up wheels, belts and rolls

**HARRISON & COMPANY, Inc.**
HAVERHILL, MASSACHUSETTS

## Personals

Promotion Manager since 1936, has assumed new responsibilities in the fields of market research and sales development. **S. S. Deputy**, Sales Manager, will work closely with the General Sales Manager on special assignments. **Bernard Lester** of Lester and Silver will continue as sales management consultant to the Sales Division and to general management.

Mr. Silver brings to American Wheelabrator 23 years experience in engineering management, particularly as applied to the distribution, promotion and sale of industrial equipment. He was a former partner in the firm of Lester and Silver and for many years Executive Vice-President of the F. J. Stokes Machine Company, Philadelphia, leading manufacturers of pharmaceutical, chemical-processing and special equipment.

Mr. Rich, an alumnus of Dartmouth, Northwestern University and Armour Institute of Technology, started in 1934 in the Company's foundry, was shifted to Chicago as Sales and Service Engineer, and rose to District Manager in 1945.

Mr. Andrus, a mechanical engineering graduate of Purdue University, was associated with the consulting engineering firm of Sargent & Lundy, Inc., before joining American Wheelabrator in 1934.

Mr. Lenhard is a graduate of the University of Notre Dame. Following his graduation from Indiana University, Mr. Deputy became a sales executive with I. B. M., joining American Wheelabrator in 1946.

According to Otto A. Pfaff, President, these appointments have been made to handle the many new applications of the company's airless and air blast-cleaning equipment, dust and fume collectors.

**Robert L. Onkey** was elected President of The Roberts Rouge Company, Stratford, Conn., and Theodore F. Onkey was elected Treasurer at a recent meeting of its Board of Directors. The other officers were re-elected.

**Kenneth S. Watson**, formerly Assistant Director of the Ohio River Valley Water Sanitation Commission, has been appointed Coordinator of industrial waste treatment for the General Electric Company.

A native of Greensboro, Pa., Mr. Watson attended West Virginia University, where he received his bachelor's degree in 1934 and a master's degree in chemical engineering in 1936.

He was Executive Secretary-Engineer of the West Virginia Water Commission before he entered the interstate pollution field. In this post he directed a statewide program of stream zoning and industrial- and domestic-water treatment. He was a member of the Interstate Commission on the Potomac River Basin, and Chairman of its Technical Committee.


FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 821.

# Cowles A M CLEANER

## THE NEW NON-ETCHING TYPE ALUMINUM CLEANER FOR USE IN SOAK TANK CLEANING

**THE NON-ETCHING CLEANER THAT REALLY CLEANS**

It was specifically designed to remove drawing, stamping, spinning compounds, rolling oils, marking inks, crayon marks and general shop dirt from common aluminum alloys prior to spot welding, anodizing or other finishing operations.

**COWLES TECHNICAL SERVICE**
Gladly Furnished Upon Request

*TRY COWLES A M CLEANER FOR A BETTER, QUICKER JOB OF CLEANING ALUMINUM*

*WRITE FOR TECHNICAL DATA SHEETS*

*PROMPT SHIPMENTS FROM WAREHOUSE STOCKS*

**COWLES CHEMICAL COMPANY**
METAL CLEANER DEPARTMENT
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NOTE Try Cowles P.C. Cleaner if you want a cleaner that really gives a rapid etch.

# Trade Literature

**L—661. Metal Cleaning**—Oakite Products, Inc., 140 Thames St., New York 6, N. Y., announces a new edition of the 44-page illustrated booklet, "Some Good Things To Know About Metal Cleaning". It discusses the wide variety of soils resulting from such metal-fabricating processes as heat-treating, forging, rolling, stamping, drawing, extruding, spinning, grinding, machining, buffing, etc.; then describes specific materials, equipment and procedures for the removal of these soils. Among the many operations reviewed in detail are tank- and machine-cleaning methods; electrocleaning; pickling, deoxidizing, bright dipping; pre-paint treatment in machines and in tanks; paint stripping; steam-detergent cleaning; barrel cleaning; burnishing; cleaning in hard-water areas; treating water for paint-spray booths; rust-prevention procedures; machining and grinding. For your copy, use Reader Service Card.

**L—662. Plating Barrels**—Two new, fully illustrated catalog folders have been published, featuring Type H and Type OLS plating barrels manufactured by Daniels Plating Barrel & Supply Company, 129 Oliver St., Newark 5, N. J. Complete description and specifications of each type are given. For your copy, use Reader Service Card.

**L—663. Clear Coating**—A transparent coating for polished and plated metals—a coating that protects against tarnishing, but "shows off" the luster of the metal—has been announced by the Adhesives and Coatings Division of Minnesota Mining and Manufacturing Company, 411 Piquette Ave., Detroit 2, Mich. It is expected to be used primarily on stainless steel, chromium plate and polished aluminum and is not intended for copper, zinc, or their alloys.

The resin-base material was originally developed for application to automobile bumpers, grilles and brightwork because of its resistance to weathering, shock and abrasion, the 3M Company said. It is now being released in brushable or sprayable forms for general industrial use. Technical information is available. For your copies, use Reader Service Card.

**L—664. Rubber-lined Pipe Joints**—The Gates Engineering Company, Box 1711, New Castle, Del., has announced a comprehensive catalog and engineering manual for the Gaco Rubber-lined Pipe Joint System. It illustrates how the system eliminates the costly and time-consuming methods of pre-engineering and pre-fabricating sections of rubber-lined pipe and how, by virtue of their unique design, the new Gaco joints may be installed in the field. It contains a complete list of fittings and specifications for rubber-lined pipe, plus a list of corrosives to which Gaco gaskets and linings are resistant. For your copy, use Reader Service Card.

**L—665. Polyethylene-coated Galvanized Electrical Tubing**—This material is offered by Steel and Tubes Division, Republic Steel Corporation, 224 E. 131st St., Cleveland 8, Ohio, for use in plants where electrical raceway systems require extra protection. Described in an 8-page illustrated bulletin, "Dekoron-Coated Electrunite EMT" has a 0.02-inch thick or thicker polyethylene coating in black or special colors. The bulletin gives data on chemical resistance; liquid transmission; electrical, mechanical and thermal properties; and illustrates methods of coupling and repair. For your copy, use Reader Service Card.

**L—666. Small Finishing Tools**—Precision Supply & Machine Company, 9-11 Church St., Paterson, N. J., offers an 8-page illustrated Catalogue No. 3 that describes a variety of brushes; felt wheels, cones and bobs; buffs; lapping, polishing and superfinishing compounds; flexible shafts; abrasive wheels and points; and other finishing material. For your copy, use Reader Service Card.

**L—667. Books on Finishing**—Practical Publications, Inc., 1142 N. Meridian St., Indianapolis 4, Ind., has published a catalogue listing a number of books dealing with such subjects as silk-screen printing, wrinkle finishing, color standards, paint mixing, and paint-and-varnish technology. For your copy, write to the publisher.

over
one million amps
of Sel-Rex
PLATING POWER
PROVEN PERFORMANCE
WE are proud of the success record Sel-Rex Selenium Rectifiers enjoy in the world's largest plating plants . . . (one company alone has over 56,000 amps of Sel-Rex Plating Power).
The largest single unit rectifier built to date is a Sel-Rex development. No matter how small or large your power requirements may be, Sel-Rex Rectifiers can be designed and built to suit your special needs.
Specialists in Plating Power to the Electroplating Industry
Automatically controlled by this operating panel
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SELENIUM Sel-Rex RECTIFIERS
BART-MESSING CORPORATION
229 Main Street • Belleville 9, N. J.
Manufacturers and distributors of Plating and Polishing Equipment and Supplies.

# The Effect of Impurities in Nickel Solutions

## ...and Methods of Purification

Bright nickel baths are usually much more sensitive to impurities than are matte nickel solutions, and certain contaminants are much more harmful than others. The effect of these contaminants and some methods of purification in current use are indicated below.

**ARSENIC** tends to lower the tensile strength of nickel deposits. It also causes dull, streaked, brittle deposits. The Liscomb method successfully removes arsenic.

**CALCIUM** sulphate in a nickel bath causes roughness, pitting and dullness. Filtration readily removes suspended crystals.

**CHROMIUM** contamination tends, generally, to reduce cathode efficiency and produce deposits in a marked degree of stress. The contaminant can be removed by the Liscomb method, by precipitation at a high pH, or by formation of insoluble lead chromate.

**COPPER** has the effect of producing dull, dark deposits in the low current density regions, and general fogging of the deposit in other regions. Most effective removal of traces is achieved by a low current density electrolysis at low pH, high temperature and high rate of agitation.

**IRON** as colloidal ferric hydroxide causes roughness. In a soluble form it codeposits with nickel. This impurity causes one form of pitting. Low current density electrolysis or high pH treatment removes iron.

**LEAD** causes dark, streaked deposits, and non-adhesion of nickel. Low current density electrolysis removes lead.

**NITRATES** in a nickel solution strongly depress current efficiency. High concentrations may stop deposition entirely. Electrolytic reduction at the cathode removes this impurity.

**ORGANIC SUBSTANCES** of many types, including grease, waxes, dust, etc., are detrimental. Their removal usually involves oxidation or carbon filtration, or both treatments.

**SULPHUR**, in the form of organic compounds, has a brightening effect in many types of nickel solutions. Nickel sulfide is harmful because it results in evolution of hydrogen sulfide and precipitation of sulfides. Although carbon treatment removes some organic compounds containing sulfur, and a high pH precipitates sulfides, there is no general method for removing traces of sulfur compounds.

**ZINC** in amounts of 0.007 oz/gal is a brightener in dull-nickel plating baths, but higher concentrations yield brittle deposits which may be dark or streaked. The Liscomb method can reduce zinc concentrations. However, low current density electrolysis is the most widely accepted process.

### AES RESEARCH PROGRAM

The American Electroplaters' Society is conducting a comprehensive research program and has developed useful information on current plating problems. International Nickel, in addition to its other support of this program, feels that it will be a further service to make copies of these AES Research Reports available. For an authoritative 36-page bibliography and correlated abstract, we offer you a free copy of the AES Research Report, Serial No. 15, entitled "Effect of Impurities and Purification of Electroplating Solutions." Use the coupon, now.

EMBLEM OF INCO SERVICE

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

Please send me a copy of AES Research Report, Serial No. 15, entitled: "Effect of Impurities and Purification of Electroplating Solutions."

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**THE INTERNATIONAL NICKEL COMPANY, INC.** 67 WALL STREET NEW YORK 5, N. Y.

SARAN LINED steel pipe

Cut "downtime" to a minimum! Saran lined steel pipe can be cut and threaded in the field as easily and quickly as ordinary steel pipe—involving NO costly delays with special tools or handling. And, once installed, saran lined steel pipe means dependable long term operation. In addition to excellent corrosion resistance, this remarkable pipe offers you the plus values of rigidity and pressure strength.

These advantages are of prime importance to you in the reduction of shut-down time and equipment replacement. INVESTIGATE saran lined steel pipe today! Mail this coupon for full information. *Saran lined steel pipe is manufactured by The Dow Chemical Company.*

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# Equipment and Supplies

**E—747. Lacquer Heater**—The "Reliable Viscolator", developed and manufactured by the Reliable Products Manufacturing Company, 123 De Kalb Ave., Brooklyn 1, N. Y., is designed to make possible the spraying of high-solids-content lacquer, synthetic and similar material at elevated temperatures. With the use of predetermined thermostatically controlled temperatures, 60 per cent more solids may be sprayed with hot synthetic than with cold, and 45 per cent more solids with hot lacquer, it is said.

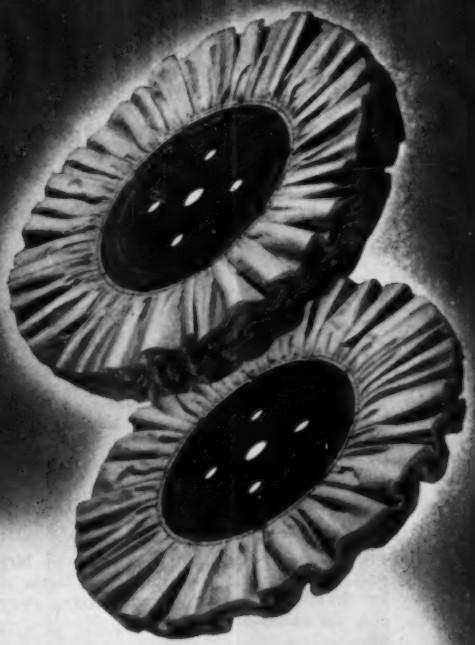
The "Viscolator" heats the material to reduce its viscosity, by electricity, steam, or both. It is manufactured in capacities from 8 to 250 gal/hour output in the non-recirculating and recirculating types. The recirculating type is recommended for use with hot lacquer. All units up to 40 gal/hour are electrically heated. Features include: easy cleaning of clogged tubes without dismantling; easy accessibility for pressure or temperature adjustment; rapid heating; absence of explosion hazard; pilot light to indicate operation of electric heating elements and material-temperature indicator. For further information, use Reader Service Card.

**E—748. Paint Heater for Hot-Spray Finishing**—A low-cost, tandem-type paint heater designed for hot-spray technique in applying lacquers, enamels, varnishes, paints, priming and surface compounds is now being marketed by the Dualheet, Inc., Dept. TF4, 10118 Detroit Ave., Cleveland 2, Ohio.

Features of design and utility include: single or tandem installations mounted on the wall or equipped with casters; tandem installations may be ganged together in one jacket so that several colors are available at proper temperature at all times; 5 inches square and 19 inches long, each unit weighs 28 lb without material circulating system; Underwriters Laboratories-approved for use in Class 1, Group D, hazardous locations; cast aluminum throughout; extra sensitive thermostat;

*Unsurpassed!*

*Ventilated*
NON-FRAY
BUFFS



*by*

# CODMAN

*For Over 55 Years the Greatest Name in Buffs*

Buffing and Polishing Wheels of Every Type for Every Operation

## F.L.&J.C. CODMAN COMPANY

ROCKLAND · MASSACHUSETTS

THE CODMAN NON-FRAY VENTILATED BUFFS ARE MADE UNDER PATENT NUMBERS 2,027,863; 2,094,650; 1,573,961; RE. 19,894; 2,140,208. OTHER PATENTS PENDING.

BRANCH OFFICES: PHILADELPHIA · DETROIT · LOS ANGELES · INDIANAPOLIS · GRAND RAPIDS

SPARKLER FILTERS · SPARKLER FILTERS

# FREE DRAINAGE IN SPARKLER FILTERS

Cross-section of individual plate, showing perforated metal screen, filter media, and filter cake.

High flow rates cannot be assured by large filtering surfaces *alone*. Another important factor is provision for drain-off space capable of carrying away all liquid that the surfaces can handle.

In Sparkler filters, the Free Drainage design of Sparkler horizontal plates eliminates one of the primary causes of liquid flow frictions — providing a clear, unobstructed channel through which filtered liquid can drain rapidly and more completely. To accomplish this, Sparkler uses a series of smooth, widely spaced buttons as the means of supporting the filtering surface, thereby ending the need for heavy wire mesh or other types of media support that have high coefficients of friction.

Features such as these, hidden from the eye, are typical of standard Sparkler construction, and are responsible for Sparkler superiority. Coupled with highest quality, operational economy, and simplified maintenance, free drainage makes Sparkler filters ideal for every filtering need and makes them particularly well adapted to the filtration of viscous liquids.

SPARKLER horizontal plate FILTERS

**Available in a complete range of sizes and materials.**

***Write for your copy of our new catalog.***

**SPARKLER MANUFACTURING COMPANY**
**Mundelein, Illinois**
*Sparkler representatives in all principal cities.*

SPARKLER FILTERS · SPARKLER FILTERS

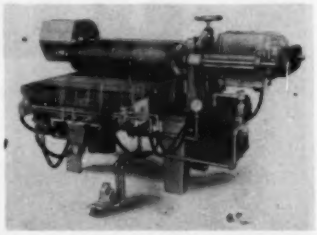
## *Equipment and Supplies*

temperature and pressure gauges included. For further information, use Reader Service Card.

**E—749. Abrasive Cloth Strip**—Behr-Manning, Troy, N. Y., Division of Norton Company, has redesigned its packaging of Lightning Metalite Cloth "Handy Rolls". The cloth is an aluminum oxide-coated abrasive designed for use on all ferrous and nonferrous metals. In strip form of 1-, 1½- and 2-inch widths, it is packaged in rolls of 50-yard lengths, and in grits ranging from 24 (very coarse) to 500 (very fine).

The old type wood core has been replaced with a nonallocated-metal cup core. A standard-size arbor hole of 7/8 inch allows for perfect alignment in rack storage of multiple rolls. The chipboard side-wall protectors have been enlarged to reduce the chance of damage to the edges of the strip—a most important requisite in such operations as cam-shaft finishing, hand strapping, deburring, and fine metal-finishing operations. For further information, use Reader Service Card.

**E—750. Surface Finishing Machine with Vacuum Chucking Mechanism**—A surface-finishing machine capable of holding nonmagnetic items without interference with coverage of the entire work



surface has been introduced by Clair Manufacturing Company, 1016 S. Union Ave., Olean, N. Y.

The Clair Model 203 Machine, a horizontal, electro-hydraulic unit, has a moving work table consisting of a perforated plate mounted over a sealed air space, this space being connected to a vacuum pump through a 4-way spring-return foot valve. Offering a maximum working area of 38 x 36 inches, the perforated plate is

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covered by a rubber mat. In operation, the table moves "in and out" ¾–36 inches and "sideways" 1½–1¾ inches under the revolving buff spindle. Without interfering with the vacuum action, raised pads, conforming to the contours of the parts being finished, eliminate the danger of buffs coming in contact with the mat.

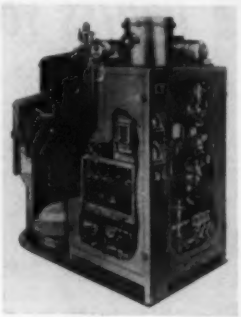
The machine may be supplied with 5-, 7½-, 10- or 15-hp motors and with buffs up to 12 inches in diameter and 40 inches in length. It is available with smaller vacuum tables, platform-type tables for mechanical holding, and in a variety of modifications.

The unit is particularly recommended by the manufacturer for use in finishing compacts, cigarette cases, lithograph sheets, flatiron sole plates, blanking stock, kick-and-push plates, fan blades, name plates, escutcheon plates, etc. For further information, use Reader Service Card.

**E—751. Soak Solvent Cleaner**—Du-Lite Chemical Corporation, Middletown, Conn., announces the development of Dynakleen, a powerful new soak solvent. Designed specifically for the quick removal of buffing and drawing compounds from knurled or fluted surfaces of all metals, it is said to remove all types of soils, including greases, oils, and discolorations, in less than 1 minute. Requiring no heating or special tanks, it can be used in spray washing machines or applied by hand. It is a safety solvent, which dries quickly and can be used repeatedly with only occasional filtration.

Dynakleen is said to be an ideal conditioner for metal surfaces prior to plating, painting, parkerizing, bonderizing, and galvanizing. For further information, use Reader Service Card.

**E—752. Steam Generator**—Vapor Heating Corporation, 4501 W. 16th St., Chicago, Ill., announces that Vapor-Clarkson steam generator Model 4740, developed to supply large quantities of high-pressure dry steam to heat diesel-powered passenger trains, is now ready to supply processing steam for cleaning, plating and processing solutions. This powerful steam generator develops 200-psi steam pressure in 2 minutes from 50°



F water and produces 4800 pounds of 99 per cent dry steam per hour, 82 per cent efficient. With No. 2 fuel oil, the unit releases 1,000,000 Btu per cubic foot of combustion space. The hot gases wipe over the 702 feet of steel coil, turning water pumped through the coil in steam. One electric motor (or gasoline engine on portable units) drives the water pump, fuel pump, blower, and magneto. Once the unit has been started automatic controls take over, causing the machine to turn on and off and produce steam only when needed. Steam pressure may be changed from 75 to 600 psi by turning one control.

A servo control automatically modulates the machine to produce from one-third to full capacity. Many safety controls have been incorporated. This package unit is 52 inches wide, 76 inches long, 78 inches high overall. For further information, use Reader Service Card.

**E—753. Phosphate Treatment for Paint Base**—Anchorite 100, a new phosphate compound for treating metal parts, produced by Octagon Process, Inc., 15 Bank St., Staten Island 1, N. Y., is said to be one of the few pre-painting treatments that meet the specification for a Class C (Type II) finish in U. S. Army Spec. No. 57-0-20. It also meets the Armed Services specification JAN-C-490, Grade 1. It is applied to steel, iron, zinc and cadmium parts.

Application is said to be inexpensive and simple, requiring no elaborate equipment. Applicable by either immersion or spray, it is adapted to both small and large production needs. The immersion process utilizes a series of five tanks constructed of mild steel. Zinc and cadmium require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¼–1 minute, some steel alloys occasionally as much as 5 minutes. The solution is made by adding a small quantity of Anchorite 100 to a large volume of water; thus its use is very economical. The spray process is recommended for high-speed treatment of such products as automobiles, washing machines and bicycles. For this method, a five-step spray chamber machine is used.

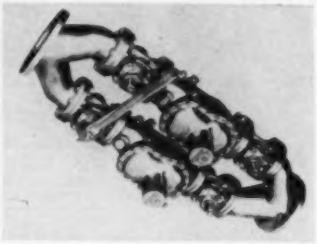
Octagon also produces phosphate coating treatments that meet the requirements of Class A and B finishes in U. S. Army Spec. No. 57-0-20, Type II. For further information, use Reader Service Card.

**E—754. Buffing Lathe**—Lewis Roe Manufacturing Company, 1050 De Kalb Ave., Brooklyn 21, N. Y., has recently improved its ¼-hp machine for light buffing and coloring. Ac or dc motor driven, it has a 22-inch long (longer if desired) ¾-inch spindle, turned down at the ends to ¼-inch and threaded 8 square threads per inch. Features include self-aligning ball-bearing pillow blocks, device for uniform tensioning of V-belt, taper points for spindle ends, and easy portability. For further information, use Reader Service Card.

**E—755. Bright Dip**—Rossaul Company, 170 Fifth Avenue, New York 10, N. Y., announces that Rossaul Copper-Brite, bright dip for brass, copper, bronze, nickel, silver, phosphor bronze, beryllium copper and most other copper alloys, is now in accord with A/N, AF, ORD, and AEC specifications for bright dips on nonferrous metals that require (1) "After clear water rinse, shall leave no residue that will interfere with conductivity", and (2) "Leaves nonferrous metals in a passivated state, resistant to further oxidation".

Said to be safe to handle, nontoxic and nonfuming, not to require special drains or ventilation, not to etch, and not to discolor silver solder, the dip is packaged in 1-gal bottles and 13-gal carboys. For further information, use Reader Service Card.

**E—756. Manifold-Type Water Meter**—Large water users have long had the problem of proper meter maintenance without costly shutdowns or extra-hour work.



To answer this problem a new compound meter manifold unit has been introduced by the Rockwell Manufacturing Company, 400 N. Lexington Ave., Pittsburgh 8, Pa. The assembly consists of two Pittsburgh-Empire single-register compound meters, four Nordstrom lubricated plug valves and two 8-inch reducing manifolds, so arranged that one side may be shut down at a time for repair or exchange without complete interruption of service.

The manifold assembly has the same flow capacity—1,600 gal/min—as the American Water Works Association requirement for a 8-inch compound meter, and a laying length within its standard for a single 8-inch compound meter. For further information, use Reader Service Card.

**E—757. Water-displacing, Rust-preventive Oils**—Petrobase 210, a synthetic composition which imparts rust-preventive properties to petroleum oils, petrolatums and waxes, is a recent development of Pennsylvania Refining Company, Butler, Pa.

Because of its polar character, Petrobase 210 in small quantities causes oils and waxes to displace preferentially water from metal surfaces. This property also prevents redeposition of corrosive aqueous vapors or liquids on the metal surface. It is recommended by the manufacturer for use in (1) Government specification preservative oils and compounds; (2) industrial preservative or "flushing" oils; (3) water-displacement fluids which selectively "wet" metal surfaces causing a thin oily film to be deposited on the surface for rust prevention and fingerprint suppression. For further information, use Reader Service Card.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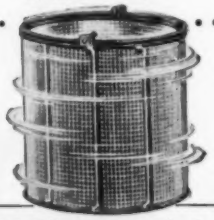
**Basket (below).** Heavy gauge woven steel mesh over steel frame. Capacity, 1140 cu. ins.



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**. . . Maximum operating flexibility permits a wide range of solution composition.**

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**POLISHING:** The brass rough casting ❶ was put through three polishing operations—ROUGHING with No. 80 Artificial Abrasive on a 16-inch wheel at 1900 r.p.m., dry; FINING with No. 120 Artificial Abrasive on a slightly softer wheel, also dry, and OILING with No. 180 Natural Emery on a ¾" spiral sewed 14-inch canvas polishing wheel (medium hard) at 1900 r.p.m., lubricated with Stevens No. 2 Tallow Stick.

**BUFFING:** The polished casting ❷ was then buffed with Stevens No. 47 Tripoli on a Stevens radial sewed, 16-pocket, 86/93 count buff 14 inches in diameter at 2100 r.p.m. The casting ❸ was then ready for electroplating.

**COLORING:** Following the electroplating process the casting was buffed with Stevens No. 101 Chrome Composition on a Stevens 64/64 folded buff, 14 inches in diameter at 2100 r.p.m. The resultant beauty and high luster is apparent in ❹

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SEPTEMBER, 1951 VOL. 38, NO. 9



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*This month's cover picture shows an automatic copper-nickel plating unit with diaphragmed anode compartments in the Ford Motor Company, Monroe, Mich., plant. An illustration from E. A. Blount's convention paper, courtesy Ford Motor Company, Dearborn, Mich.*


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PLATING is abstracted regularly in Chemical Abstracts, Engineering Index, Technical Data Digest and Bulletin Analytique.


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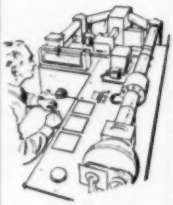

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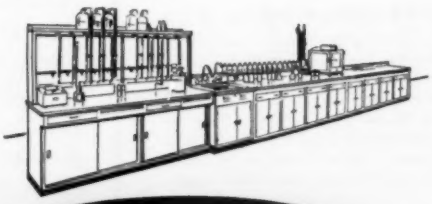

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# Editorial

## Live and Learn

IN ONE SENSE everyone is a learner. In childhood he receives impressions that form his character, and as he lives on, he collects information, some true, some false, that is used to create beliefs and to guide future action.

Here, however, we are primarily concerned with learning in a more narrow sense, learning how to become skilled electroplaters.

Whether the electroplater begins as a helper and tankman or machine operator, or whether he is put in the plating room because he has shown abilities elsewhere in the plant, his first step in learning is to collect pieces of information, one after the other, as he goes about his tasks. A few men can retain an amazing amount of detail and put it to use profitably. But the ordinary man finds that knowing the mere mechanics of the work and tricks of the trade does not make him a good electroplater. The sooner he recognizes that there must be some order and logic to knowledge, the sooner he can tackle efficiently the difficult problems that arise. The pieces must be fitted into a pattern.

Fortunately, electroplating has progressed far enough that a basic pattern does exist. It can be found in simple form in such books as Glasstone's "The Fundamentals of Electrochemistry and Electrodeposition", published by the American Electroplaters' Society, and Blum and Hogaboom's "Principles of Electroplating and Electroforming", published by McGraw-Hill Book Company. The second step in learning to become a good electroplater is to study such books and restudy them until the pattern becomes clear.

The third step is to fit the everyday observations into the pattern. It is a disappointing task at first. Many pieces that in the beginning seemed to fit in one place do not fit the next piece. But the effort is worthwhile. Nothing compares with the exhilaration that is felt when piece after piece falls into place, as in a jig-saw puzzle, and the observations begin to make sense.

The learner soon realizes that gathering knowledge by his own observations is a slow process. More knowledge is required. Actually, there is a large store available in books and periodicals and in the minds of fellow platers. The fourth step, therefore, is to gather such knowledge in a systematic fashion and to fit it into the pattern.

As his knowledge and experience grows, the plater finds that some pieces cannot be made to fit. He discovers that they were not based on fact but on faulty observation or wrong interpretation, and he is ready to take the fifth step, learning to be critical and learning to check and double check. He also finds that the original pattern was incomplete and imperfect, and he takes the sixth and final step in the process of learning, improving upon the pattern.

And so the plater keeps on observing and studying and building his pattern, and finds problems becoming simpler each year that goes by. He lives and learns, and he enjoys himself.

Gustaf Soderberg

THIS STUDY

*was made in 1935 in connection with the development of bright-zinc plating. It is being published now with the hope that the basic data presented will be of some value to those who have been forced into zinc plating by shortage of other plating metals or who feel the need for a better knowledge of zinc plating fundamentals.*

*The object of the tests was to determine the effects of variations in zinc, sodium cyanide and sodium hydroxide concentrations upon the appearance of deposits, cathode current efficiency, Haring-cell throwing power, limiting anode current density, and electrical conductivity of zinc cyanide plating solutions. Only the effects on the first two, appearance and efficiency, are reported in this installment.*

# SOME CHARACTERISTICS OF ZINC CYANIDE PLATING SOLUTIONS

## I. Appearance of Deposits and Cathode Current Efficiency

GUSTAF SODERBERG, *Editor*, PLATING

### INTRODUCTION

Little need be said about the appearance of the plate, except that good appearance adds to the salability of a product and makes it easier for it to pass inspection. The deposits described here are bright only after bright dipping, and even at best do not have the highest lustre obtainable; that can be had only by the use of brighteners, which is not covered by by this study. However, the conditions under which the best deposits are obtained from the plain bath, as a rule, also produce the best deposits from baths containing brighteners.

Cathode current efficiency and cathode current density determine the rate with which the metal is being deposited. It takes 829 amp-min/sq ft (88.3 amp-min/dm²) to deposit an average thickness of zinc of 0.001 inch (25 $\mu$) at 100 per cent efficiency. That means (82,900/*ab*) minutes at *a* asf and *b* per cent efficiency [(8,930/*a'b*) minutes at *a'* amp/dm² and *b* per cent efficiency]. For example, an 0.0005-inch (12.5-$\mu$) deposit at 50 asf (5.4 amp/dm²) and 80 per cent efficiency requires

$$\frac{0.0005}{0.001} \times \frac{82{,}900}{50 \times 80} = 10.4 \text{ minutes}$$

$$\frac{12.5}{25} \times \frac{8.930}{5.4 \times 80} = 10.4 \text{ minutes}$$

The importance of thinking of plating speed in terms of both current density and cathode current efficiency will be demonstrated by results of this study. In fact, in certain baths the efficiency will be found to drop more rapidly than the current density is increased, causing a decrease in rate of plating as the current density is increased beyond a certain value.

Although a large number of determinations were made throughout this investigation, its scope, nevertheless, is somewhat limited. Thus, no studies were made on solutions having a metal content higher than 4.5 oz/gal (34 g/l) or at any temperature other than 77° F (25° C). This is unfortunate because the use of somewhat higher metal contents is sometimes beneficial, and higher temperatures are often encountered in summer time and, regularly, in barrel plating.

Another limitation is that all tests were run singly. The absence of multiple determinations makes it impossible to evaluate the accuracy of any particular result. The general consistency of results, however, speak for their general reliability.

### EXPERIMENTAL

*Test Specimens*

Bright cold-rolled SAE 1010 steel test pieces, 4x1¼ inch (100x32 mm), were scrubbed thoroughly with pumice, rinsed under the tap, dipped in 50 per cent (by vol) conc'd hydrochloric acid, rerinsed under the tap, rinsed in distilled water and in alcohol, and dried in air. Those specimens which were to be used for efficiency determinations were placed in a dessicator, and later weighed.

*Equipment*

The plating set-up consisted of a series of 400-ml beakers on two opposite sides of each were placed anodes of 99.99 per cent zinc sticks. Each beaker contained 300 ml of plating solution. Above the beakers

was held a piece of wood with vertical holes, through which heavy brass wire led to near the top and center of the beakers. The lower end of each brass wire was inserted in the vertical hole of a brass battery connector and fastened thereto with a screw. The lower end of each connector, in turn, had a vertical slot, in which the test piece could be held by another screw.

The previously cleaned test pieces were fastened in the connectors, rinsed under the tap, dipped quickly in dilute hydrochloric acid solution in a series of beakers, rinsed under the tap again, and lowered into the center of the plating solutions to a depth of 2 inches (50 mm) in such a manner that they faced the anodes. Tests had shown that the second dip in acid did not affect the weight of the specimens. The cells were then connected in series with one another and with a copper coulometer, an ammeter, a carbon-pile rheostat, and a 12-volt lead storage battery. The current was adjusted immediately to give the required current density, 0.0347 ampere on the 5-sq in (32.3-cm²) area for each ampere per square foot (0.108 amp/dm²). The plating was continued for a length of time judged sufficient to deposit about 0.0002 inch (5 $\mu$) of zinc.

At the end of the plating time the test-piece assembly was lifted out of the plating cells, and the test pieces were immersed in a row of beakers with tap water to avoid staining of the zinc surface. The test pieces were then disconnected and rinsed under the tap, in distilled water and in alcohol, and hung up to dry. After drying, the "efficiency specimens" were kept in a dessicator until they were reweighed. All specimens were then inspected for appearance, dipped dry for 5 seconds in a bright dip containing 30 g/l hydrogen peroxide and 0.7 normal in formic acid, rinsed in water and alcohol as before, dried in air, and inspected for appearance as bright dipped.

After each plating test, the coulometer cathode was rinsed in water and alcohol and the alcohol burnt off before the cathode was placed in a dessicator and weighed. The cathode efficiency was calculated in the usual manner from the weight gains of the test piece and the coulometer cathode.

*Plating Solutions*

All plating solutions were prepared from USP zinc oxide made by New Jersey Zinc Company, previous tests having shown that the then available zinc cyanide and other grades of zinc oxide introduced impurities which interfered with the bright dipping.

The zinc oxide was dissolved in a stock solution with the required amount of cp sodium hydroxide and the minimum amount of technical sodium cyanide in the particular series of tests. Solutions of higher cyanide contents were made by adding solid sodium cyanide to the stock solution.

The "total sodium hydroxide" referred to here includes both the actual sodium hydroxide used in the preparation of the solution and the sodium hydroxide formed on solution of the zinc oxide according to the equation

$$ZnO + 4\ NaCN = 2\ NaOH + Na_2Zn(CN)_4$$

Inasmuch as the molecular weight of the zinc oxide (81.38) is substantially equal to two molecular weights of sodium hydroxide (2 x 40.01 = 80.02) each reported total sodium hydroxide content consisted of the zinc oxide content plus the added sodium hydroxide content.

## Results

*Appearance*

The appearance of the as-plated specimens has been classified as lustrous, semilustrous and matte. Actually, there is a gradual change, in that some specimens classified as matte were white and showed a trace of lustre, whereas others were matte gray, and some classified as lustrous were not as highly lustrous as others. In interpreting the data in Fig. 1. one should therefore remember that specimens at or near the boundary lines are intermediate in appearance.

None of the specimens was bright as plated; those classified as lustrous all had a yellowish cast. All, however, turned bright on bright dipping, but a difference in lustre persisted after bright dipping, indicating a difference in structure. Hence, the charts in Fig. 1 also represent the bright-dipping results.

*Cathode Current Efficiency*

The results are presented by means of three-dimensional graphs* in Fig. 2.

All values for 50 asf (5.4 amp/dm²) in solutions containing 3.5 oz/gal (26 g/l) zinc and 9, 10 and 11 oz/gal (67, 75 and 82 g/l) total NaOH were obtained by extrapolation of curves drawn through 10-, 20-, 30-, 40- and 44-asf points. With the set-up used, anode polarization prevented obtaining higher cathode densities over the length of time required.

## Discussion of Results

*Appearance*

It should be noted in comparing the data, that the

*The use of the three-dimensional graphs permits plotting of three variables, here total NaOH, total NaCN, and efficiency, at the same time, and hence presents a clearer view of their interdependence.

The axis of a graph of this kind may be considered to extend from a lower corner of a room; here the efficiency axis upwards where the two walls meet, the NaOH axis along the right-hand wall where it joins the floor, and the NaCN axis along the left-hand wall where it joins the floor. The surface representing the efficiency results is raised above the floor.

The efficiency is obtained by locating the composition on the base plane (floor), drawing a vertical line upwards until it meets the corresponding point in the efficiency surface, and measuring the distance between the two points. Measuring the same distance along the efficiency axis (from the lower corner upwards) gives the efficiency. In Fig. 2, each 1/8 inch (3.2 mm) represents 10 per cent efficiency.

For example, to get the efficiency at 10 asf of a solution containing 3.5 oz/gal zinc, 10 oz/gal total NaOH, and 9 oz/gal total NaCN, one locates the 10 NaOH, 9 NaCN point in the right hand, middle graph, and measures the distance straight upward to the corresponding point. It is slightly less than 1¼ inch = 10/8 inch, or slightly less than 100 per cent. At 50 asf the corresponding distance is slightly over ½ inch = 4/8 inch, or slightly over 40 per cent.

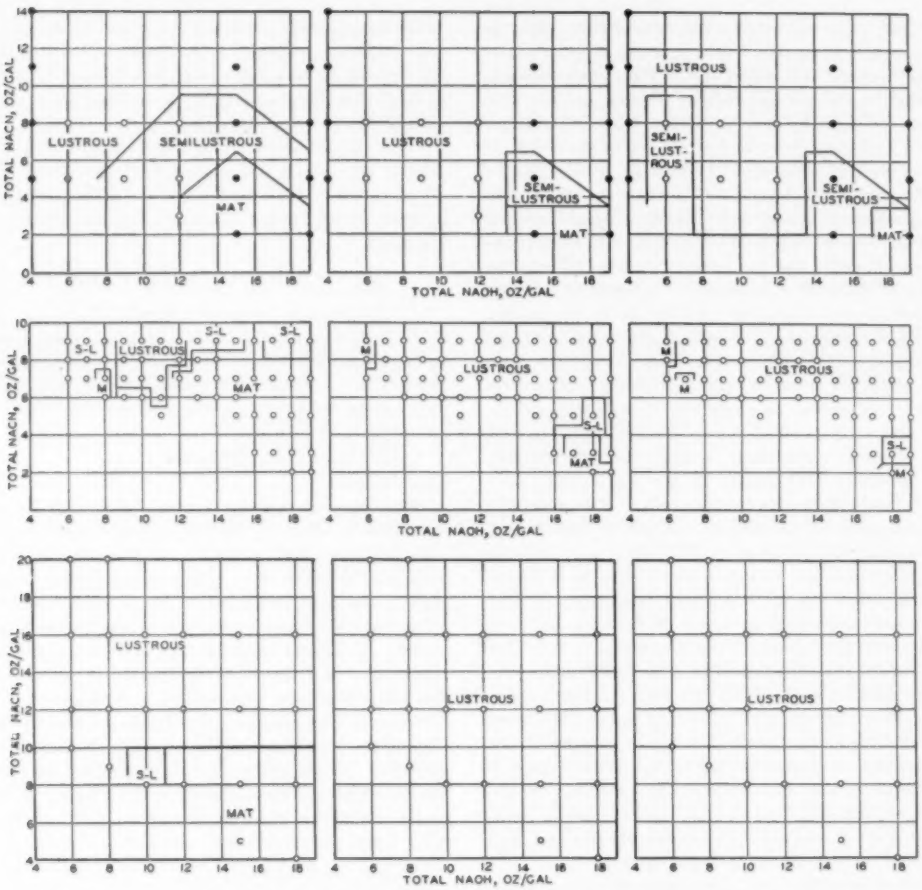



*Fig. 1. Appearance of zinc deposits as plated at 77° F. From top to bottom: 2.4, 3.5, 4.5 oz/gal zinc. From left to right: open circles 10 asf, filled circles 15 asf; open circles 30 asf, filled circles 25 asf; open circles 50 asf, filled circles 40 asf*

graphs for different metal contents in Fig. 1 do not cover the same ranges of total cyanide content. Also, the position of the boundary lines between different appearances becomes increasingly uncertain as the distance between the observed points increases.

Most striking is that, in general, the higher the total sodium cyanide content and the lower the total sodium hydroxide (caustic) content, the more lustrous is the deposit.

Some exceptions to the general rule are noted, a semilustrous or matte deposit having been obtained, where lustrous plate would have been expected, under the following conditions:

| Case | I | II | III | IV |
|---|---|---|---|---|
| Zn, oz/gal | 2.4 | 3.5 | 3.5 | 3.5 |
| Total NaCN, oz/gal | 5–8 | 6–9 | 8–9 | 7 |
| Total NaOH, oz/gal | 6 | 6–8 | 6 | 7 |
| Current density, asf | 50 | 10 | 30, 50 | 50 |

The effect of increased cathode current density is to widen the range for lustrous plate toward lower total NaCN and higher total NaOH contents. Again, cases I and IV listed above are exceptions.

An increase in the zinc content at 10 asf (1.1 amp/dm²) generally reduces the lustre but can be counteracted by an increase in total cyanide content. At 30 and 50 asf (3.2 and 5.3 amp/dm²) an increase in metal content from 2.4 to 4.5 oz/gal (18 to 34 g/l) is beneficial to appearance.

The widest range of composition within which good deposits may be obtained is had with 4.5 oz/gal (34 g/l) of zinc and at 30–50 asf (3.2–5.3 amp/dm²).

*Cathode Current Efficiency*

When Fig. 2 is studied, one observes at once several irregularities. Whether these irregularities are real and represent shifts in the complex-cyanide: "zincate"

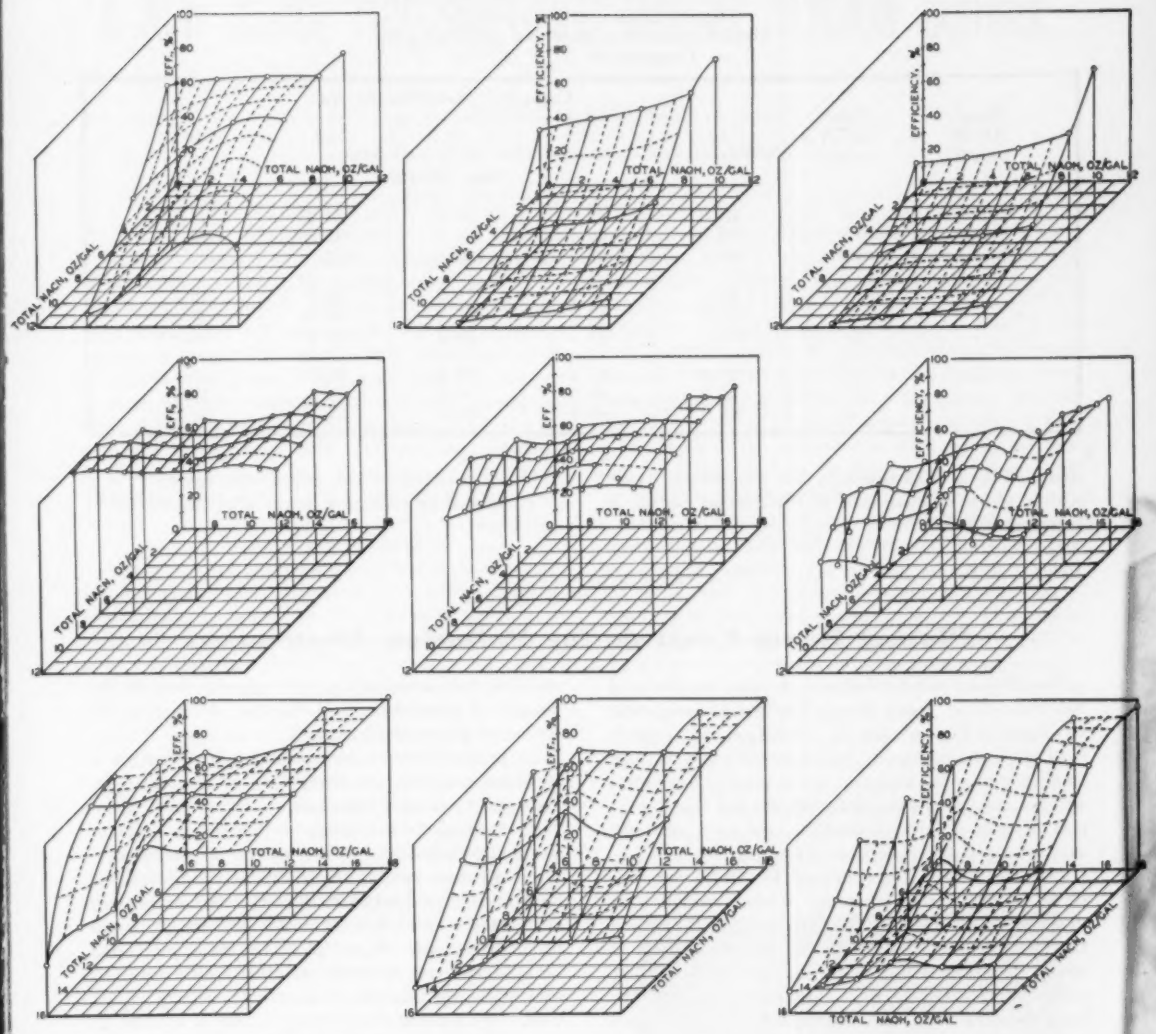



*Fig. 2. Cathode current efficiency of zinc solutions at 77° F. From top to bottom: 2.4, 3.5, 4.5 oz/gal zinc. From left to right: 10, 30, 50 asf. Each 1/8-inch elevation over the base plane represents 10 per cent efficiency*

equilibrium or are caused by faulty observations cannot be said.

However, certain trends are evident. The efficiency decreases with increased total cyanide content and current density and with decreased metal content.

The effect of increasing the total sodium hydroxide (caustic) content is usually to increase the efficiency.

The greatest interest is in the data for the 4.5–oz/gal (34–g/l) solutions, because they show the highest efficiencies. Some of the data have been recalculated in terms of plating rate and shown in Table I. The data on which the 20- and 40-asf (2.2- and 4.3-amp/dm²)results are based were obtained experimentally.

It will be noted that, on account of the rapid decrease in efficiency, at 8-10 oz/gal (60–75 g/l) total sodium hydroxide (caustic) and 12 oz/gal (90 g/l) total sodium cyanide, it does not pay to increase the current density above 30 asf (3.2 amp/dm²), and one may expect the same situation to exist also at slightly higher and slightly lower sodium cyanide concentra-

TABLE I. TIME REQUIRED TO DEPOSIT ZINC
Deposit Thickness: 0.001 inch (25 μ)
Metal content of solution: 4.5 oz/gal (34 g/l)
Temperature: 77° F (25° C)

| Total NaOH oz/gal | Total NaCN oz/gal | Cathode Current Density, asf | | | | |
|---|---|---|---|---|---|---|
| | | 10 | 20 | 30 | 40 | 50 |
| | | Time, minutes | | | | |
| 8 | 9 | 83.8 | 43.5 | 30.0 | 24.2 | 21.4 |
| | 12 | 86.0 | 49.7 | 45.0 | 45.5 | 46.5 |
| | 16 | 159 | 163 | 122 | 112 | 100 |
| 10 | 8 | 85.3 | 42.2 | 28.2 | 22.0 | 18.2 |
| | 12 | 82.9 | 45.5 | 37.2 | 40.5 | 39.9 |
| | 16 | 132 | 107 | 88.2 | 85.9 | 80.0 |
| 12 | 8 | 82.9 | 42.0 | 28.5 | 21.6 | 17.5 |
| | 12 | 82.9 | 43.5 | 30.6 | 28.1 | 27.0 |
| | 16 | 83.8 | 60.8 | 64.0 | 59.5 | 54.2 |

tions. This is approximately the composition range within which a great deal of commercial plating is being carried out.

CONCLUSIONS AND ACKNOWLEDGMENTS

These will be presented in the final installment of this article.

## Plating Room Controls for Pollution Abatement

The Metal Finishing Industry Action Committee of the Ohio River Valley Water Sanitation Commission has issued a 20-page manual, "Plating Room Controls for Pollution Abatement", which should prove of value to all platers. The adoption of the proposed measures will not only reduce the elaborateness and thereby the cost of waste-treatment facilities, but they will also save money in the operation of the plating plant.

Because *dragout losses* account for 60–80 per cent of all supply costs—excepting anodes—reduction of dragout losses are given first attention. Permitting thorough drainage back into the processing tank is always practical if fog rinses are used on work that cannot be allowed to dry. Drainage bars over the hand-operated tank, drip-boards between tanks, and automatically timed hoist-raising devices are recommended, as is the use of one or more "save rinses". The concentration of the last of these should not exceed 5 per cent of the concentration of the processing bath. To facilitate return of save-rinse solution to baths that do not evaporate fast enough, one may arrange for drainage of the parts before they enter the processing tank, thereby reducing dragin, or for concentration of the save-rinse solution by heating, or both.

To reduce dragout (and save plating metal) racks should be kept insulated and free from treeing. Similarly, racks should be built to facilitate drainage and undue buildup of plate on certain areas.

By the use of dam-type overflows across the full width of the *rinse tank* and by introducing the rinse water at the bottom of the tank opposite the exit, the volume of rinse water and thereby the cost of the treatment plant can be reduced.

To prevent *solution leakage* and other losses, it is recommended that all equipment be inspected for leaks and for need of maintenance, at scheduled intervals. A device for measuring electrical conductance of steam condensate used in the heating of plating solutions will show leaks in the heating device, which can be localized by introduction of compressed air in place of the steam. All solution-transfer mechanisms should be in plain view. Water pipes for filling processing tanks should end above the solution level to prevent back siphonage into the drinking-water system. Float valves can prevent overflowing in case of a break in the steamline or if a feed line is left open inadvertently. Storage tanks, sumps, pits or a tank around the processing tank will save an overflowed solution.

Spilled solution should be absorbed into Fuller's earth and not be flushed into the drainage system where it may overload the waste-treatment facilities.

Contaminated processing *solutions* should not be discarded but *salvaged* or sold. Salvaging methods include treatment with activated carbon, low-current-density purification, high-*p*H treatment, oxidation, low-temperature crystallization, settling and decantation, filtration, precipitation.

The manual is illustrated with line drawings and photographs, and can be had for 50 cents from Edward J. Cleary, Executive Director, ORSANCO, 414 Walnut Street, Cincinnati 2, Ohio.

# A NEW DEVICE FOR SIMPLIFIED SURFACE TENSION CONTROL

JOSEPH B. KUSHNER

*Joseph B. Kushner Electroplating School, Stroudsburg, Pa.*

## Introduction

Surface tension is an important property of many of the solutions used in the plating room. For example, most bright-nickel solutions contain substances that reduce the surface tension, so-called wetting agents, to prevent gas bubbles from adhering to the work and cause pitting. The same type of material is often added to solutions used to produce chromate films on zinc or even to pickling solutions in order to wet the work surface more uniformly and produce more even results. There is, therefore, a need for devices for measuring surface tension, quickly and easily.

## Existing Instruments

In the average plating shop, surface tension, where controlled, is usually measured by a device called a stalagmometer—Greek for drop measurer—which is essentially a fine capillary tube extended at one end into a bulb-type reservoir and ground at the other end to an accurately flat tip. The principle behind its operation is the fact that the weight of a drop of liquid falling from the tip is a function of the radius of the tube and the surface tension of the liquid.

To eliminate the radius of the tube, which is difficult to measure accurately, from the calculations, the stalagmometer is calibrated with a liquid of known surface tension (and specific gravity). A further simplification involves the drop weight, for which one substitutes the volume of the bulb multiplied by the specific gravity of the liquid and divided by the number of drops contained in the bulb. In this manner, one obtains a very simple expression for practical use:

$$\phi = k\frac{d}{n} \qquad (1)$$

where

$k = \phi_k n_k / d_k$, and

$\phi$ = the unknown surface tension, in dynes/cm, of the solution being tested

$\phi_k$ = the known surface tension, in dynes/cm, of the calibrating liquid

$d$ = the specific gravity, in g/cm³, of the solution being tested

$d_k$ = the specific gravity, in g/cm³, of the calibrating liquid

$n$ = the number of drops of the solution being tested contained in the stalagmometer bulb

$n_k$ = the number of drops of the calibrating solution contained in the stalagmometer bulb

On first examination this method for measuring surface tension looks simple enough, but in use several difficulties arise which make the process tedious and troublesome. Probably the major difficulty is that the capillary requires excellent cleaning before use—those who have cleaned stalagmometers know what a job it is! Another source of annoyance is that the drops form at a very low rate. That is a requisite for accurate measurements, but counting the number of drops that fall becomes a time-consuming operation. Finally, the tip of the tube must be held strictly horizontal for really accurate measurements—a minor but nevertheless bothersome point.

At times plating-solution surface-tension measurements are also made with a tensimeter of the De Nouy type, which measures the surface tension of a liquid by the amount of force required to pull a wire ring of fixed length away from the liquid surface. This instrument, while highly accurate when properly used, is very expensive. It is also quite delicate and is more at home in the quiet cleanliness of a laboratory than in the rugged climate of a plating shop.

For these reasons many platers do not bother with surface-tension measurements in spite of their importance. Instead they leave it to a supplier's laboratory to furnish them with an occasional surface-tension measurement, or they judge the surface tension by the way the solution foams under agitation and by its

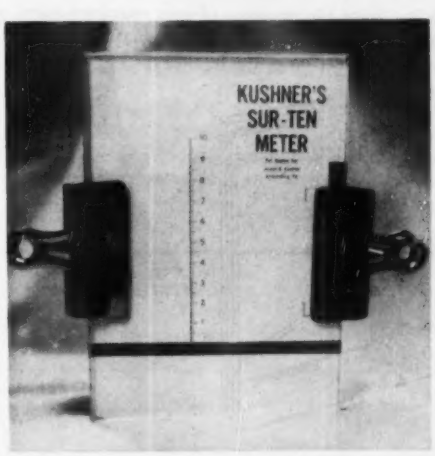



*Fig. 1. The new device, the Sur-Ten Meter, for measurement of surface tension*

general behavior in operation, based on previous experience. Unfortunately, infrequent control is insufficient and unreliable, and control of the rule-of-thumb type is much too crude, particularly when the surface tension of a given solution reaches a borderline value. What is needed is a quantitative method of control that can be used by the plater, quickly and easily, right on the job.

### The New Device

To fill this need, the writer has designed a device* to enable the plater to obtain relatively accurate surface-tension measurements, simply and speedily. The principle behind this Sur-Ten Meter (Fig. 1)†, well known for many years, is as follows:

When two glass plates are held together at a minute distance from each other and are partially immersed in a liquid which wets glass‡, the liquid between the plates is drawn up by capillary action. If now the plates are brought together along one vertical edge to form a very small known angle with each other, the liquid surface takes the shape of a hyperbolic type of curve (Fig. 2). The equation for this curve, at constant depth of immersion, is a measure of the surface tension of the liquid. The derivation of the equation is presented in the Appendix.

Two English experimenters, Ferguson and Vogel[1] were able to get results accurate to within 1 per cent using this technique, but found precise measuring of distances along the plates too difficult and tedious for practical use. An ingenious German experimenter by the name of Grunmach[2] devised a rather complicated gadget which enabled him to vary the angle between the two plates in a controlled manner. On the front plate he had engraved a family of hyperbolic curves as indicated in Fig. 3. By adjusting the angle between the plates it was possible to make the liquid surface coincide with one of the hyperbolic curves on the plate. Since the equation of each engraved curve was already known, it was a simple matter to calculate the surface tension of the liquid.

The careful measuring technique used by Ferguson and Vogel is entirely impractical for routine shop use, even though it is capable of considerable accuracy. The Grummach technique, although very clever, involves a fairly delicate mechanism which can hardly be expected to stand up to regular use in a plating room—to say nothing of its high cost.

For these reasons, the writer devised another technique making use of the glass plates that greatly simplifies the process, at a small sacrifice in accuracy, and puts the method in the realm of practicality for the plating shop.

By standardizing the small angle between the plates by means of suitable clamps and positioners and by always immersing the assembly to the same depth, a given liquid will always rise to form the same curve. As shown in Fig. 2, this curve is characterized by the height $y$ of the liquid above the immersion line at any arbitrarily chosen distance $x$ from the line of intersection of the two plates. All that is necessary to define such a height is to print a liquid-level line and a graduated vertical line on one of the glass plates of the fixed assembly.

As shown in the Appendix there is no need for the curve equation if the apparatus is standardized against a liquid of known surface tension and specific gravity and if the specific gravity of the liquid being tested is known. The only thing that is needed is to insert the known values and the heights of the two liquids in the following simple equation:

$$\phi = Kyd \qquad (2)$$

where

$K = \phi_k/(y_k d_k)$, and
$\phi$ = surface tension being measured
$\phi_k$ = known surface tension of the standard liquid
$y$ = measured height of the liquid being tested
$y_k$ = measured height of the standard liquid
$d$ = specific gravity of the liquid being tested
$d_k$ = specific gravity of the standard liquid

The simplest liquid for standardizing is pure water.

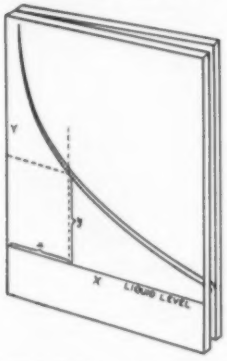
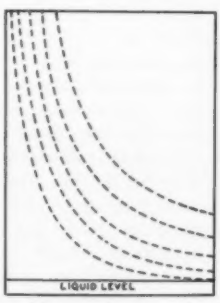



*Fig. 2. Principle of the new device*

*Fig. 3. Principle of the Grunmach variable-angle tensimeter. The equation for each curve is known*




*Design patent applied for.
†Copyright 1951 by the author.
‡A transparent plastic cannot be used instead of glass because of its poor wettability by water.

and tap water will do for practical purposes if not too high in solids content. Its density and surface tension are very close to those of distilled water.

As shown in Fig. 4, the values of $\phi_k/d_k$ do not vary a great deal through ordinary room temperature, and 78.2, the value at 20° C (68° F) can be used for shop control. One may, therefore, determine the height $y_k$ at room temperature and use a constant $K = 72.2/y_k$ in equation 2.

When measurements are to be made at any other temperature than room temperature, the calibration should be made at the same temperature, using the proper value of $\phi_k/d_k$ for the calibration liquid. For example, at 50° C (122° F), the surface tension $\phi_k$ of pure water is 67.9, its density 0.988, and $\phi_k/d_k$ 68.7.

We have here then an easy and quick method for obtaining the surface tension of any solution with an accuracy more than sufficient for routine plating control (the accuracy is at least 5 per cent or better). The two simple glass plates are readily cleaned and conveniently stored. Being printed with a ceramic fired enamel they cannot be harmed by any of the solutions in the plating room with the exception of fluorine-containing acids, and they are relatively impervious to scratching because of their hardness.

### Accuracy of the Device

To test the accuracy of the commercial unit a few solutions of known surface tension were checked, along with two bright-nickel solutions with surface tensions that had been previously determined with a stalagmometer. The results are given in Table I.

These test results indicate that the instrument is more than sufficiently accurate for all plating-control purposes and for general surface-tension control where required.

### Use of the Device

To use the device, the two glass plates are separated and the inside surfaces are swabbed with a small amount of warm alkaline cleaning solution right from the cleaner tank, thoroughly rinsed with water, and swabbed with a small amount of the solution to be tested. The two plates are then fitted together with the spring clamps furnished, and the assembled instrument partially immersed in the plating tank up to the printed solution-level line. For more accurate results,

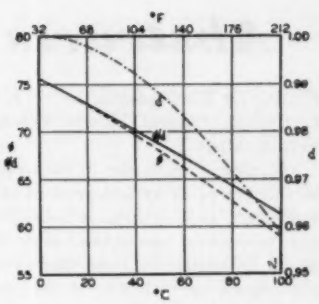



*Fig. 4. Effect of temperature on surface tension $\phi$, specific gravity d, and the function $\phi/d$ for water*

the plates are made to rest vertically in a miniature tank supplied with the instrument, and the plating solution is poured in until the level line is reached. After 30 seconds the curve has stabilized, and a reading $y$ is taken where the curve cuts the millimeter scale. This reading, multiplied by the constant $K$ and the specific gravity of the solution $d$ (obtained with an ordinary hydrometer), gives the surface tension of the plating solution.

Because of the possibility of parallax errors, all readings must be taken at eye level. For this reason it is preferred that each plater calibrate the device himself according to the way he reads the scale.

It takes five minutes, at the most, to get a reading on the instrument.

### A Simplified Method

In much routine control, multiplication by the constant and the specific gravity can be forgotten. Thus, for example, if the plater gets a reading of 20 mm when the solution has the correct surface tension, and the next day he gets a reading of 30 mm, he knows that the surface tension has increased by about 50 per cent and can add wetting agent to bring it down to the original correct value. The amount to be added to a big tank can be readily determined by testing the effect of small additions to the miniature tank and multiplying the correct amount thus found by the ratio between the shop-tank volume and the miniature-tank volume.

### Summary

A simple, inexpensive and quick method for routine

(*Continued on page 938*)

TABLE I. ACCURACY TESTS

| Liquid | Sp. Gr. at 20° C $d$ g/cm³ | Known Surface Tension $\phi$ dynes/cm | Observed Height $y$ mm | Calc. Surface Tension $\phi$ dynes/cm | Error % |
|---|---|---|---|---|---|
| Distilled water | 0.998 | 72.8 | 45.5 | .... | .... |
| Antarox, 0.5% soln | 1.00 | 28.0 | 18.0 | 28.8 | 2.9 |
| Acetone | 0.79 | 23.7 | 19.1 | 24.3 | 2.5 |
| Bright Nickel "A" | 1.20 | 42.8* | 21.5 | 41.3 | 3.5 |
| Bright Nickel "B" | 1.17 | 43.3* | 23.0 | 43.0 | 0.7 |

*By stalagmometer.

# Abstracts of Convention Papers

*Rinsing for Electroplating*, by R. J. Rominski and F. L. Clifton, General Motors Research Laboratories, Detroit, Mich.

The rinsing operation in electroplating should not be thought of as an independent step in the plating sequence. It is intimately related to the preceding and succeeding operations, and rinsing techniques should be engineered from this viewpoint. The cost and efficacy of each step in the cleaning cycle is directly influenced by the intermediate rinsing steps, and the success or failure of the plating operations may depend wholly on the proper choice and efficient operation of the rinsing techniques.

The selection of one of the three common types of rinsing, i. e., still tank, spray, or fog, must be made on the basis of both technical and economic considerations. Each has advantages and disadvantages which must be evaluated for each application.

There are several variations for even so simple an operation as still-tank rinsing. Agitation is an important variable, and can be achieved in a variety of ways. Movement of the water or the work, or both, is desirable, but the nature of the movements, their extent and duration must be tailored to fit the work being rinsed.

Spray rinses are usually used in connection with still-tank and hot-water rinses and offer savings in several ways, e. g., by keeping the final hot rinse cleaner, by causing less spotting of the work, and by reducing the steam consumption in the hot rinse.

Fog rinses are often used on racked work as it comes out of the plating solution. They are capable of reaching more remote recesses than spray rinses, and because of the small volume of water required, attractive applications which decrease drag-out losses and reclaim-rinse volume can be engineered.

It is a mistake to neglect the possibilities of economies, both direct and indirect, and of superior technical operation which may accrue from the use of purified or treated water in many rinsing operations. Modern techniques for softening, demineralizing and distilling water present the plater with an attractive array of possibilities from which he can select those best suited to his problems.

*Practical Applications of Diaphragm Tanks in the Electroplating Industry*, by Ezra A. Blount, Editor, Products Finishing Magazine, Cincinnati, Ohio.

The simplest form of diaphragm-tank installation comprises a tank which is separated into anode and cathode compartments by means of porous diaphragms, plus auxiliary equipment for pumping the solution from the anode compartment, through a filter, and back into the cathode compartment. This elementary arrangement may be modified to include heat exchangers, electrolytic purification tanks, and other special equipment required in a particular process.

Although the obvious advantage of the diaphragm tank is the elimination of individual anode bags, which are a nuisance with nickel and a virtual impossibility with high-speed copper, it has been found in practice that other benefits may be realized. Higher anode current densities may be used; roughness caused by stray dust, dirt from make-up chemicals, or other sources is reduced; and it is easier to buff the plated work. It must not be imagined, however, that diaphragm tanks will solve all plating troubles; even sources of roughness will remain operative.

Experience has shown that although conventional tanks can sometimes be converted successfully into diaphragm tanks, it is best to install new tanks complete with all accessory equipment. Only in this way can optimum arrangements be made for all parts of the system, particularly means for removing solution from the anode chamber and introducing it into the cathode chamber.

Although 11- or 12-oz canvas duck, with a service life of from six months to a year or more, is the most popular diaphragm fabric, a number of synthetic materials have been investigated. Nylon, Dynel and Chemstrand are among those which show promise.

The diaphragm-tank system has no limitations, small or large, so far as size is concerned, and its benefits may be realized in the laboratory, in the small job shop, or in an enormous automatic line.

*Methods of Heating and Temperature Control of Plating Solutions*, by W. E. Stadel and C. Civan, George L. Nankervis Company, Detroit, Mich.

Accurate control of plating-bath temperature is necessary for the successful operation of modern plating processes. The permissible range of temperature variation is usually ± 5° F, but in some cases the fluctuations must be limited to ± 2° F.

Steam is the usual source of heat, and it may be used in either internal coils or external heat exchangers. Internal coils are satisfactory for alkaline cleaners, hot acid dips, strikes and other solutions of comparatively small volume, but the contents of large tanks should be heated by means of external heat exchangers. In these cases it is important that the hot solution be returned to the plating tank through a series of headers located at the bottom of the tank and protected with suitable grids.

The size of a heating coil or heat exchanger may be calculated from the specified heat-up time, capacity of tank, operating temperature, and steam pressure. It is not usually necessary to consider heat losses caused by radiation or the introduction of cold work inasmuch as the excess capacity required for heat-up will cover all heat losses during normal operation.

Iron equipment can be used for alkaline cleaners and for cyanide strikes which contain no organic material.

Acid-resistant materials must be used for internal and external apparatus for the handling of acid solutions. Steel pipes lined with rubber or plastic are suitable for most acid baths.

Air-operated controllers are recommended where close temperature control is required, and they may be adapted for either heating or cooling or both. Self-operating instruments which are actuated by vapor pressure from a thermal element in the solution may be used where comparatively coarse control is adequate.

*Advantages of Simplicity in the Electroplating of Automobile Bumpers*, by Donald H. Schantz, Assistant Vice-President, Michigan Bumper Corporation, Grand Rapids, Mich.

When preparations were made to resume production of automobile bumpers after World War II, the pre-war plating sequence was investigated to determine if a simplification would lead to improvements in quality and costs. A promising and important possible simplification was the elimination of the copper flash, which not only reduced the number of steps in the sequence but also the waste-disposal problems.

In the new sequence, cleaning is done in two steps. The first is an anodic cleaner, and the second makes use of alternating current to demagnetize the bumpers and prevent the accumulation on their ends of iron particles which lead to roughness in the nickel deposit. All rinsing is done in spray-rinse tanks.

The key to successful adhesion of the nickel directly to the steel lies in the use of an anodic treatment in a solution of 65–70 per cent by volume of 66° Bé sulfuric acid at 60 asf and 80–100° F for 1.5 min, followed by a rinse prior to nickel plating. It has been observed that this treatment is responsible for a small amount of smoothing of the steel surface.

The substitution of a proprietary semibright nickel solution for a low-*p*H Watts bath and other changes in the nickel plating operation permitted an increase in current density and a decrease in buffing costs.

Cathodic cleaners are used in preparation for chromium plating, and oxidation of the nickel is thereby kept at a minimum. The work is treated for a few seconds at low voltage in the chromium-plating tank under conditions which do not deposit any metal before the working voltage is applied. This helps to secure a bright chromium deposit. Occasional rejects owing to cloudy chromium are stripped of chromium and replated.

The product is believed to be equal if not superior to that produced by more complicated sequences. The cost has been low, and the production has been twice that originally expected.

*Requirements of Zinc Base Diecastings for Electroplating*, by Glenwood J. Beckwith, Vice-President and General Manager, Metallon Products, Inc., Los Angeles, Calif.

Zinc-base diecastings which are suitable for electroplating can be produced only when due care is exercised with regard to the design of the article, the design of the dies, the casting technique in the foundry, and the composition of the zinc alloy.

The design of the article should be such that polishing can be easily accomplished without expensive special equipment or excessive hand labor. The designer should also keep in mind the requirements of the plater with respect to ease of racking for good contact, proper drainage, and satisfactory throwing of metal to all parts of the article.

A die which is not properly designed will be the source of castings that contain coarse-grained areas, cold shuts, rough surfaces, and other defects which cause the plater a great deal of trouble and may lead to a ruinous number of rejects. Even trimming dies which are not properly aligned or are otherwise faulty will produce castings that are hard to polish, and the excessive polishing may well cause plating troubles.

Foundry technique which does not recognize the effects of metal and die temperatures, lubricants, poor skimming, and the use of excessive amounts of scrap in the pot will inevitably lead to poor castings that will be difficult to plate properly. Even the type of furnace is important. A gas-fired furnace, for example, may be the cause of porous castings if the metal is exposed to the products of combustion. Probably no single factor is so important as proper foundry technique in the production of good castings.

Some of the impurities which may find their way into diecasting alloys can be the source of important plating troubles. Lead and cadmium are particularly troublesome, and even small amounts will cause blistering after plating. Many other impurities, such as tin, promote subsurface corrosion, and cause effects which may be blamed upon the plater.

*Mechanical Finishing of Zinc Base Diecastings Prior to Plating*, by M. R. Caldwell, Assistant Vice-President, Doehler-Jarvis Corporation, Grand Rapids, Mich.

A properly designed die with a well polished and chromium plated cavity should produce diecastings with a surface that would need no buffing prior to plating. However, even in the absence of surface defects as the casting is removed from the die, the parting lines must be trimmed off and polished, and these operations generally cause nicks and scratches that necessitate buffing of the entire bright area.

The dense "skin" on the casting should be preserved during buffing in order that the number of corrosion spots in use be kept at a minimum. Only very shallow pores in the surface can be bridged during copper-nickel plating; others can be removed by polishing or hard buffing for maximum corrosion resistance. However, air pockets in shallow pores will expand during baking of the plated castings and raise blisters.

Machine finishing is a necessity to reduce cost and meet production requirements in the author's plant with its large production—in 1950, 280,000 castings

daily, weighing 0.43 lb on the average and 15.5 lb maximum.

Size and contour, required final finish, presence of holes and threads, possibility of distortion, and adaptability to automatic machine polishing are factors which are taken into account in the choice of finishing method.

Many small parts are barrel burnished, sometimes after a strapping (belt polishing) of the parting line, in 2-compartment, 32-inch diameter, 60-inch long barrels, run at 30 rpm at first and then 6–10 rpm for final coloring.

Parting lines are usually strapped, by hand or automatically, before buffing. Abrasive belts are preferred to set-up wheels because of elimination of skilled labor and savings in material and labor. Polished areas and coarseness of polishing grain are continually kept at the minimum required by the condition of the part, and use of grease stick at a maximum, to reduce cost of subsequent buffing. Type of buff and buff speed are carefully selected for the same reason.

Liquid tripoli buffing compounds are rapidly gaining favor, even in hand buffing, and are carefully selected for minimum consumption, buff wear, and ease of removal by cleaning. Applications can be made automatic. The recirculating pump-type system is preferred over the pressure-can system because it eliminates transfer of compound and keeps it uniform.

A wide variety of automatic buffing machines are used: semiautomatic, reversing type with only one fixture (two to a part), straight-line and return-type full-automatic with fixture guides and tilting mechanisms. Areas not reached on the machine are touched up by hand, sometimes with a portable high-speed head when the fixture is turning an end of a return-type automatic.

Optimum wheel pressure, once set, is controlled by an ammeter on the motor, which automatically considers the wheel speed.

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## A New Device

(*Continued from page 935*)

surface-tension control in the plating shop capable of 5 per cent accuracy or better has been proposed.

### APPENDIX

#### The Surface Tension Curve

The equation of the surface tension curve can be determined analytically, as follows:

Consider first two parallel plates a very small distance $b$ apart. On the assumptions that (1) the meniscus is cylindrical in form and (2) the contact angle between the glass plates and the liquid is zero, which it almost always is in the case of water solutions, the equation for the rise of the liquid between the plates above a fixed datum (the level of the main body of liquid) is given by

$$h = \frac{2\phi}{gb(d-D)} \qquad (3)$$

$h$ = the rise in centimeters
$\phi$ = surface tension of the liquid
$g$ = acceleration of gravity
$b$ = the distance between the glass-plate surfaces
$d$ = the density of the liquid
$D$ = the density of the surrounding medium (air)

If the glass plates are inclined to each other at an angle of $\theta$ radians, the distance between the two plates at any point $x$ centimeters from the vertex as measured horizontally along one of the plates is $2x\sin(\theta/2)$. If $\theta$ is very small, then $\sin(\theta/2) = \theta/2$, so that the distance for very small angles becomes equal to $x\theta$. With the $Y$ axis the line of intersection of the two plates and the $X$ axis the line of intersection of the liquid surface and the glass plates, the height of the liquid surface at any point $y$ is given by

$$y = \frac{2\phi}{gx\theta(d-D)} \qquad (4)$$

Rearranging to solve for $\phi$ gives

$$\phi = \frac{xyg\phi(d-D)}{2} \qquad (5)$$

As can be seen at once this equation has the form $XY$ = a constant, which is that of a rectangular hyperbola. In actuality, the curve deviates slightly from the hyperbolic form, particularly if the angle $\theta$ is greater than 1°, but for the purposes for which this instrument is intended such a deviation is completely negligible.

#### The Simplified Calculation

With distilled water as a calibrating fluid, suppose the distilled water curve cuts the millimeter scale at a point $y_k$ millimeters from the X axis. Then using the plating solution to be tested as the capillary fluid, suppose the millimeter scale is cut at the point $y$. According to equation 5,

$$\phi_k = \tfrac{1}{2}xy_kg\theta(d_k-D) \qquad (6)$$
$$\phi = \tfrac{1}{2}xyg\theta(d-D) \qquad (7)$$

If we divide one equation into the other, there results:

$$\frac{\phi}{\phi_k} = \frac{y(d-D)}{y_k(d_k-D)} \qquad (8)$$

since everything cancels out but the heights and the densities.

Because the density of air $D$ is negligible as compared to that of water or heavier solutions $d$, the $D$ term may be dropped, and there remains

$$\phi = \frac{yd}{y_kd_k}\phi_k \qquad (9)$$

REFERENCES CITED
[1]Proc. Phys. Soc. **38**, 193 (1925).
[2]Physik. Z. **11**, 980 (1910).

## *Review of the Month*

# FLOORS AND DRAINS IN PLATING DEPARTMENTS—SOME NOTES

**W. E. Stadel**

*George L. Nankervis Company*
*Detroit, Michigan*

From evidence gathered over a period of years, it would appear that the plating industry in general has not paid sufficient attention to the proper installation of floors and drains in plating departments.

Observation indicates that too many of these floors do not afford satisfactory service without excessive maintenance. Drains too come in for considerable criticism, particularly because they plug up too often, and cases have been reported where acid action has caused the entire sewer system to disintegrate because improper materials had been used in its construction.

These conditions, it is believed, do not exist through ignorance alone, because excellent information is available, and specifications have been written which cover floor construction to meet almost all requirements. Perhaps one excuse is the budget. Almost everyone wants to obtain the most operating or dollar-producing plating machinery for the money expended on new equipment. Floors and drains have not been considered in this category, and, as a result, insufficient funds have been allocated to their construction.

Plating-department floors must perform a number of functions. Not only must they sustain the plating equipment and resist abrasion where personnel walk upon them, but they must also provide a spillway or drain for waste solutions to the sewer system. The base of most floors is Portland cement of sufficient strength, reinforced with steel in accordance with accepted engineering practice, to do this work without cracking.

One of the most important factors in floor design, and one which is too often overlooked, is proper drainage. Areas over which waste solutions are to flow should be sloped sufficiently toward drain points that no water remains in puddles. If this is done properly, it is also helpful in maintaining good housekeeping where these areas are periodically flushed with water.

In most instances, it is necessary to cover the concrete floor in the plating department with a protective coating. The type of coating best suited for this purpose will depend upon the conditions under which the floor is to be used.

For several conditions, where the floor must withstand constant spillage of unusually concentrated plating-room wastes or of acid-pickling-department wastes, the best possible protection should be provided. This may consist of a good grade of mastic directly over the concrete followed by complete coverage with acid-proof brick cemented in with acid-proof cement. In some cases it might even be advisable to cover the brick with another coat of a mastic that is impervious to the type of waste material involved. For normal floor requirements, a more economic coating, of two layers of mastic, can be applied over the concrete. The first layer is usually of a type affording good bond to the concrete, and the second is chosen because of its resistance to either acid or alkali, dependent upon which is to be in contact with the floor. Another less expensive protective coating is common asphalt or pitch applied hot over the concrete.

Plating-department drain systems which carry concentrated acids should be constructed of high-silica iron throughout, and even complete lead drains have been installed in some instances to handle the disposal of particular types of waste.

Less concentrated wastes may be handled satisfactorily by using vitrified clay tile of the acid-resistant type, set in acid-proof cement.

All drain systems should be provided with cleanout facilities at proper intervals. These should be inspected from time to time to forestall plugging of the system.

Traps must also be installed to prevent sewage odors. A special type of trap may be necessary where oils or other materials of a greasy nature are likely to coat the walls of the system and eventually make it inoperable. These traps are of the accumulator type and should be cleaned out at definite intervals.

The treatment of plating wastes, outside the scope of this paper, should be carefully considered in laying out the departmental drainage system. Recent local laws vary in their requirements from a simple acid interceptor type of treatment with an alkali to a complicated complete neutralizing plant.

It is to be noted that the scope of this review is insufficient to cover complete details of the subject matter. It merely lists a few suggestions that it is good engineering practice to include in plating-department layouts.

# Washington Orders

*Copies of NPA orders and publications may be obtained from National Production Authority, Washington 25, D. C., or from any of its local offices.*

*Cadmium.*—The use of cadmium for plating was extended by an amendment dated July 30 to include spiders and brackets used in textile plants to the extent that corrosive action makes the use of other materials impracticable; all functional ferrous parts subject to the combined effect of corrosion and stress which in service reach 500° F or higher, and all parts in contact with such parts; all carburator, magneto and generator parts; threaded cast iron castings weighing 1 pound or less; prosthetic devices where use of other materials is impracticable due to corrosion. Cadmium inventories may exceed a 30-day supply or a "practicable minimum working inventory" whichever is less, when necessary because of existence of minimum purchasable quantities.

*Chemicals.—Phenol-formaldehyde resins*, with and without filler, have been added to Schedule A of Order M-32 as amended on July 17. No producer is required to accept rated orders for shipment in any one month in excess of 35 and 45 per cent, respectively, and no order need be accepted that he received less than 15 days prior to the first of the month of shipment.

Further increase in production of *synthetic detergents* may be restricted by the shortage of sulfuric acid.

A bigger supply of *polyethylene* is expected to become available in September.

*Controlled Materials Plan.*—Two clarifying amendments, Nos. 1 and 2, to CMP Reg. 1 and a clarifying Direction 5 were issued on July 12, August 1 and July 30, respectively.

Direction 1 to CMP Reg. 1 as amended on July 12 extends to all small users of steel, copper and aluminum the benefits of CMP allotments.

A new CMP Regulation 5, issued on July 6, is similar to the revoked NPA Regulation 4. It authorizes the use of the allotment symbol MRO and the rating DO-MRO. However, manufacturers of "A" and "B" products will obtain their MRO materials under CMP Reg. 1 and not under this regulation. CMP Reg. 5 was amended on July 17.

A new CMP Regulation 7 deals with repair parts and materials for repairmen.

*Copper and copper-base alloys*—Order M-11 was amended on July 1 to carry out the purpose of the Controlled Materials Plan. Principal change is the greatly increased required acceptance of authorized controlled materials orders or rated orders. It also permits rejection of ACM or DO orders by producers, sellers or owners of unalloyed copper unless such orders have been specifically authorized by NPA.

Order M-12, per Amendment No. 1 dated July 17, does no longer cover passenger automobiles and automotive parts. They are covered by Order M-68.

An amendment to Order M-47A dated August 2 makes it possible for manufacturers to benefit from any savings in the manufacturing process and permits them to disregard the weight of materials contained in purchased components or subassemblies for which a CMP allotment for the third quarter was issued. Religious jewelry, protective devices and ware; military badges, insignia, etc.; and commercial fishing tackle and gear have been added to list B. Direction 2 to this order, of July 27, deals with adjustment of quotas.

Order M-74, dated July 1, took over many of the restrictions on the use of copper and copper-base alloys in off-the-site builders hardware items formerly included in Order M-12. "On-the-site" items are controlled by Order M-4.

*Fans and Blowers.*—Fourth-quarter CMP allotments to manufacturers will be the same as the third-quarter allotment in steel but lower in copper and aluminum, and NPA has urged manufacturers to reduce gages of materials and to eliminate alloys if possible.

*Graphite and carbon electrodes.*—An amendment to M-66 of June 30 delayed third-quarter allocations to until August 1.

*Job Platers' Meeting.*—The newly formed Electroplating Industry Advisory Committee has the following members:

D. J. Griffin, Birmingham Plating Works, Birmingham, Ala.
E. T. Brown, Cadmium & Nickel Plating Company, Los Angeles, Calif.
Leo J. Schmitt, Cowan Manufacturing Company, Pittsburgh, Pa.
Louis J. DiSalle, DiSalle Plating Company, Toledo, Ohio
Louis Rosenberg, Simmons Plating Works, Atlanta, Ga.
Robert Evans, Imperial Plating Company, Inc., Providence, R. I.
Robert J. Huber, Michigan Chrome & Chemical Company, Detroit, Mich.
Paul Miller, Miller Electroplating, Inc., Evansville, Ind.
M. G. Herbach, Philadelphia Rust Proof Company, Philadelphia, Pa.
S. H. Moss, Quality Plating, Inc., Chicago, Ill.
Robert B. McDermott, Specialized Plating Company, Brooklyn, N. Y.

It met on July 27 with Charles B. Griffith, of NPA's Service Equipment Division, as the Government Presiding Officer. Representatives of the Copper and Steel Divisions discussed the availability of copper and nickel, respectively, and a representative of the Office of Small Business pointed out that information about defense contracts can be had from local representatives of his office in the NPA offices. NPA officials agreed to consider making a survey of electroplating facilities.

*Maintenance, Repair and Operating Supplies.*—NPA Regulation 4 was revoked on July 6 and is succeeded by CMP Regulation 5.

*Lead.*—Amendment No. 1 to Order M-38, dated July 26, removed all restrictions on the distribution of lead and lead products, making it primarily a conservation order.

Such restrictions are now found in a separate order M-76 of the same date, effective September 1. This new order is an allocation order for soft primary pig lead. However, allocation applications need not be filed for acceptance of such lead from a foreign source, or for acceptance of such lead in a total amount of less than 10 short tons in a month, providing no allocation application has been applied for. In the latter case, the supplier is furnished instead with a certificate of compliance with Order M-76.

Lead chemicals were removed from the definition of lead products in Order M-38, but persons producing lead chemicals must conform to the order's limitations on the use of pig lead.

*Priorities.*—NPA Regulation 2 was amended on July 17 to bring the basic rules of the priorities system up to date and to liberalize provisions concerning the use of DO ratings to replace materials taken from inventory. A new system of DO ratings, with one letter and one digit or with 2 or more letters will take precedence during the third quarter over the 2-digit DO ratings except DO-22, DO-38P, DO-41, DO45-49, DO-51, DO-62, DO-96.

*Rubber.*—Order M-2, as amended on July 17, extends small-user exemption to include those who use 150,000 instead of 25,000 lb per month. This small use, however, is limited by several requirements.

*Small Business.*—"Defense Loans for Small Business" and "Pooling Production for Defense" are the titles of two pamphlets issued for the assistance of small business.

(*Continued on page 968*)

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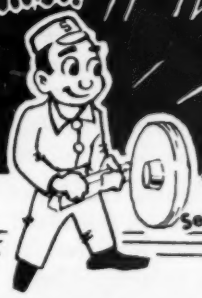

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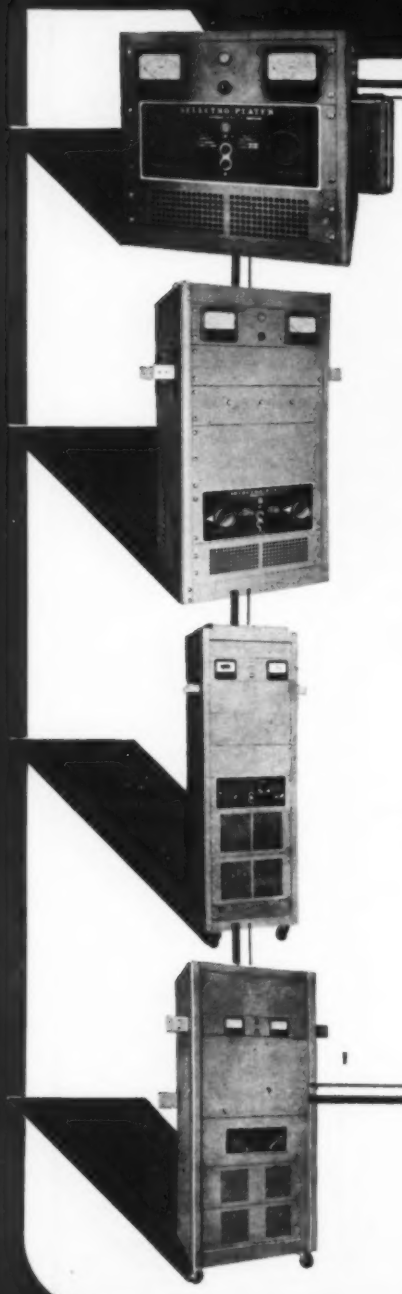

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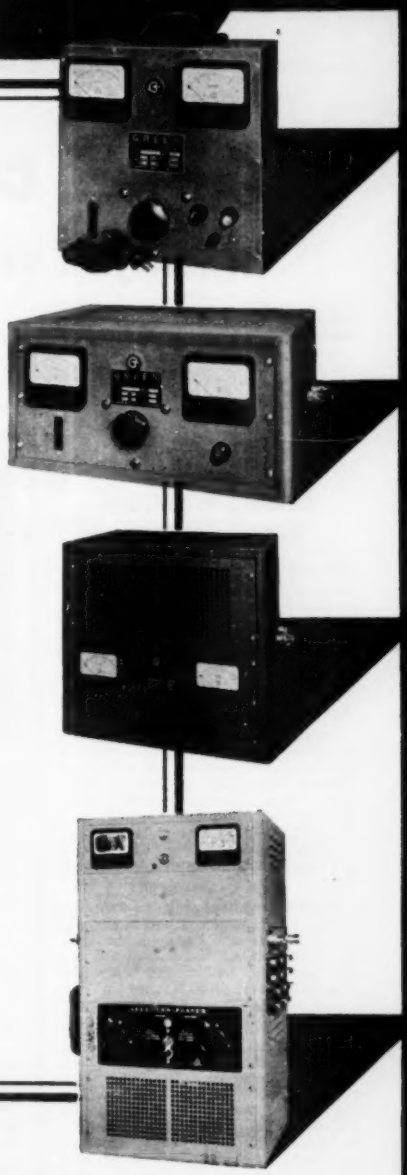

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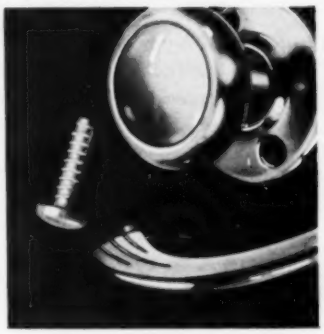

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*Note:* Users are also applying a clear, tough organic coating such as Unichrome Coating B-115. This serves to seal out corrosion and assures long life for the bright finish.

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# Methods for Testing Thickness of Electrodeposits

## III. COMPARISON OF METHODS FOR ACID COPPER ON STEEL

### Introduction

The preceding paper of this series[1] dealt with thickness measurements for nickel on steel. Results of work on a considerably different system, namely, acid-copper on steel will be described herein. This different combination of metals involves a magnetic situation that is entirely different from that of nickel on steel inasmuch as only the basis metal is magnetic. The simpler magnetic system permits the use of two additional commercial gages, namely, the General Electric thickness gage and the Lea Lectromag, which are not applicable to nickel on steel. The General Electric gage[2] depends upon the change in reluctance caused by a change in the thickness of the gap (or nonmagnetic substance) between the measuring head and the magnetic basis metal. The Lea Lectromag is a production version of the gage devised by Lipson[3], and involves the measurement of the distance a solenoid must be moved to detach its soft-iron core from a nonmagnetic coating on a magnetic basis metal. Obviously, the distance will decrease as the coating thickness increases.

All methods used in the work on the nickel-on-steel deposits are applicable to the copper-on-steel system. It was possible by applying these methods to acid-copper deposits on steel to determine whether or not the absolute accuracy and the reproducibility of the various methods is affected by a pronounced change in character of the coating-basis metal system.

The range of thickness of the acid-copper deposits which was selected for this work encompassed the same limits as the range used for nickel on steel, namely, 0.0001–0.005 inch (2.5-130 $\mu$). It was decided, however, that the number of panels with thicknesses within this range need not be so large as was used in the nickel-on-steel work. The following nominal thicknesses were selected: 0.0001, 0.0005, 0.001, 0.0025, and 0.005 inch (2.5, 13, 25, 65 and 130 $\mu$).

The current program of A. S. T. M. Committee B-8, Section A, Sub-Committee III, does not entail any work on the copper-on-steel combination, but the information which the committee will obtain on reproducibility for a given method from one laboratory to another should, however, apply to measurements for acid-copper on steel as well as to the systems which are actually being investigated. It was not considered necessary, therefore, to have the measurements repeated in other laboratories.

All of the results reported herein were obtained by a single operator who had what might be described as a moderate amount of experience in the performance of each of the several tests.

### Experimental Methods

The general technique for the prepara-

tion of panels was very similar to that used in the nickel-on-steel work[1], and the cathode box and the general plating set-up were identical with those described in the preceding paper. The basis metal was cold-rolled low-carbon steel with a No. 3 finish which came from the same coil as that used in the nickel-on-steel investigation. No additional surface preparation was used, but the pieces of steel used for the experiments were selected to eliminate panels which were scratched or otherwise defective.

It had been planned to use a solution of the composition given below, if possible without addition agents. A bath was prepared from technical-grade chemicals, treated with activated carbon, filtered, and electrolyzed at 2 asf (0.2 amp/dm²) for 24 hr and at 5 asf (0.5 amp/dm²) for 24 hr. This solution gave excellent deposits for the panels with the thinner coatings, but trouble was experienced in obtaining panels free from trees for the two thicker coatings. Repeated filtration and dummying of the solution would not yield deposits of the desired smoothness.

Several addition agents were then tried with only partial success. As a matter of fact, none of the thick deposits were as satisfactory as those which had been obtained in some preliminary work with an unpurified solution to which goulac had been added to the extent of 0.03 g/l (0.004 oz/gal). The results which were obtained with this solution were so close to those desired that it was decided to modify it or the plating conditions in an effort to obtain deposits of the desired smoothness. The latter approach was tried first. When the operating temperature was raised from room temperature to 40° C (104° F) the roughness of the deposit decreased but numerous deep elongated pits appeared. The stirrer was then moved from outside the cathode box to a position just inside the opening of the box and near the bottom insulating panel. After this modification, very smooth, pit-free deposits were obtained, and even panels having a thickness of 0.005 inch (130 $\mu$) were sufficiently smooth that Magne-gage readings could be easily made on the unbuffed coatings. A complete Magne-gage survey of the panel indicated excellent uniformity of thickness. All of the test panels were then prepared under the contions which are summarized below:

| | |
|---|---|
| Bath Composition: | |
| $CuSO_4.5H_2O$ | 250 g/l (33 oz/gal) |
| $H_2SO_4$ | 75 g/l (10 oz/gal) |
| Goulac | 0.03 g/l (0.004 oz/gal) |
| Current Density | 15 asf (1.6 amp/dm²) |
| Temperature | 40° C (104° F) |
| Agitation | see text above |
| Filtration | intermittent, as needed |

The steel panels were flashed on both sides with copper from a conventional cyanide bath prior to the acid-copper plating operation. The approximate thickness of the flash coating was as follows: for panels with a total thickness of 0.001 inch (25 $\mu$) or less, the flash coating was 0.00002 inch (0.5 $\mu$); for a total thickness of 0.0025 inch (63 $\mu$), 0.00005 inch (1.3 $\mu$); for a total thickness of 0.005 inch (130 $\mu$), 0.0001 inch (2.5 $\mu$). The thickness of the flash coating is, of course, included in all measurements. This was unavoidable; but actually it is of no detriment to the results because what was done simulates commercial practice, although it is not claimed that the ratio of cyanide-copper to acid-copper is necessarily the same as would be encountered in commercial activities. The flash on the back of the panel served to protect the steel against the chemical action of the plating bath, and was taken into account in those methods of thickness determination wherein it would be a factor.

All nondestructive measurements were made according to the pattern of test locations shown in Fig. 1 of the paper dealing with nickel on steel[1]. Specimens for destructive tests were prepared in the same way as those described in the nickel-on-steel paper*.

The microscopic, Magne-gage, and BNF jet tests were conducted in exactly the same way as described for nickel on steel, with, of course, the necessary minor modification of the BNF jet test for end-point determination. The details of the other tests will now be described.

*Stripping tests*

Except for the solution employed and the necessity for dealing with the flash coating on the back of the panels, the stripping tests were conducted exactly as in the nickel-on-steel work. The stripping solution for copper on steel which was found to be the most satisfactory is that recommended by the National Bureau of Standards and consists of 500 g/l (67 oz/gal) of chromic acid and 50 g/l (6.7 oz/gal) of sulfuric acid. This solution is used at room temperature and dissolves copper with no perceptible attack on steel, as was demonstrated by weight-loss measurements on both bare steel and steel which had been wrapped with copper wire.

Inasmuch as the backs of the panels as well as the fronts were flashed with cyanide copper, it was necessary to strip separately the front and back of each specimen. The edges and back of the weighed specimen were coated with wax and the front stripped. The wax was then removed and the specimen reweighed, and the total thickness of copper on the front was calculated from the weight loss. The specimen was then stripped and weighed again to determine the thickness of the flash on the back. This datum was needed to calculate accurately the thickness based upon the gain in weight of the cathode during the plating of the panel. The specific gravity of copper was taken as 8.9.

*General Electric thickness gage*

The instrument used for these measurements was loaned to the project by the manufacturer and is designated by him as Model A. It was used in strict accordance with the manufacturer's instructions, as set forth in the booklet which accompanied the instrument. Several thickness standards were furnished by the manufacturer, but inasmuch as they were made of comparatively soft materials and were subject to wear, they were not deemed sufficiently reliable for precise calibration. Standardization was, therefore, carried out with standard-thickness samples that were obtained from the Bureau of Standards and were used in calibrating the Magne-gage and Lectromag. Aside from the difficulties encountered in using the standards which came with the instrument, it is desirable in comparative work to use one set of standards in the calibration of all instruments.

The Model A thickness gage can be used in either of two ways. One scale is calibrated in terms of thickness and is an uneven scale; another scale is marked off in evenly spaced divisions which may be used with calibration curves. It was soon found that the first-mentioned scale is not satisfactory for precise work. If the instrument is balanced to give a correct reading at some given point on the scale, accurate readings for other thicknesses will be obtained only over a limited portion of the scale. The range of suitable accuracy was far smaller than the range of thicknesses used in this investigation. It was necessary, therefore, to use the evenly divided scale and to calibrate it for two sensitivity ranges with the above-mentioned standards.

It is necessary to exercise considerable care in the use of the General Electric gage in order to obtain results as good as those recorded herein. The instrument requires a long warm-up period before reasonable stability is obtained, and it has been found desirable to leave it turned on 24 hr per day during the period that it is in use. The zero drift is considerable

*Perhaps it should be explained that both here and in the nickel-on-steel work *one group* of specimens cut from each panel was used for *one* destructive test. Of the six available specimens in each of the four groups, only five were used normally, the single exception being the stripping test for copper on steel, where all six specimens were stripped. Inasmuch as there are but three destructive tests reported in both the nickel and copper papers, it is evident that one group was not used in each case. This group was reserved for possible additional destructive tests or for the checking, if necessary, of one of the tests which were used.

at all times, even when the instrument is operated continuously, and the zero setting must be checked frequently against bare steel that is identical with the basis metal used for the deposits. The orientation of the measuring head with respect to the rolling direction in the steel must be taken into account because it affects both the zero setting and the thickness measurements. It would not, for example, be satisfactory to obtain a zero setting of the gage with the head perpendicular to the rolling direction, and then measure a deposit with the head parallel to the rolling direction. It is, of course, possible to obtain approximate thickness readings without observing all of these precautions, but in order to obtain results which compare favorably with those obtained with the Magne-gage or the Lectromag great care must be taken. It should be recorded also that the General Electric gage indicated a variation in thickness across the width of the panels that was not noted with the other two magnetic gages.

Perhaps it would be well to point out that in situations where a very limited range of thicknesses is involved, such as may occur in production control, the direct-reading scale will serve satisfactorily if all other precautions are observed.

*Lea Electromag*

This instrument, which is a production model of the Lipson gage, was used in strict accordance with the manufacturer's instructions. It was, however, specially calibrated by us against the National Bureau of Standards standard specimens referred to above. The calibration so obtained coincided accurately with the manufacturer's calibration for thicknesses of less than 0.0035 inch (90 $\mu$), but minor deviations were noted for greater thicknesses. The discrepancy was brought to the attention of the manufacturer, and it is likely that more recent models of the gauge have a calibration which is accurate over the entire range. The Lectromag is very easy to use and the results are quickly obtained.

## Experimental Results and Discussion

The detailed presentation of the experimental data is given in Tables I–VI. These tables are arranged in the same manner as those presented in the preceding paper for nickel on steel[3] and again the nomenclature is that used in the *A. S. T. M. Manual for the Presentation of Data*[4], that is, $\bar{X}$ is the arithmetical average, $n$ the number of measurements, and $\sigma$ the standard deviation. These tables do not include the results for thickness calcu-

TABLE I. MAGNE-GAGE DATA FOR COPPER-ON-STEEL
(All Measurements in Hundred-Thousandths Inch)

| Panel Number | Thickness X | Frequency | Statistical Data |
|---|---|---|---|
| Cu-A6A | 16 | 14 | $n = 41$ |
| | 15 | 27 | $\bar{X} = 15.3$ |
| | | | $\sigma = 0.48$ |
| Cu-A6B | 16 | 5 | $n = 41$ |
| | 15 | 31 | $\bar{X} = 15.0$ |
| | 14 | 5 | $\sigma = 0.49$ |
| Cu-A7A | 63 | 4 | $n = 41$ |
| | 62 | 6 | $\bar{X} = 60.4$ |
| | 61 | 3 | $\sigma = 1.29$ |
| | 60 | 19 | |
| | 59 | 8 | |
| | 58 | 1 | |
| C-A7B | 66 | 4 | $n = 41$ |
| | 65 | 14 | $\bar{X} = 64.0$ |
| | 64 | 7 | $\sigma = 1.30$ |
| | 63 | 10 | |
| | 62 | 5 | |
| | 61 | 1 | |
| Cu-A9A | 127 | 3 | $n = 41$ |
| | 125 | 17 | $\bar{X} = 123.7$ |
| | 124 | 3 | $\sigma = 1.88$ |
| | 123 | 4 | |
| | 122 | 11 | |
| | 120 | 2 | |
| | 119 | 1 | |
| Cu-A9B | 125 | 3 | $n = 41$ |
| | 124 | 4 | $\bar{X} = 121.9$ |
| | 123 | 3 | $\sigma = 1.55$ |
| | 122 | 17 | |
| | 121 | 5 | |
| | 120 | 8 | |
| | 118 | 1 | |
| Cu-A11B | 300 | 3 | $n = 41$ |
| | 298 | 1 | $\bar{X} = 294.0$ |
| | 297 | 5 | $\sigma = 3.12$ |
| | 295 | 11 | |
| | 293 | 15 | |
| | 290 | 1 | |
| | 288 | 5 | |
| Cu-A12B | 327 | 1 | $n = 41$ |
| | 325 | 3 | $\bar{X} = 318.0$ |
| | 322 | 1 | $\sigma = 4.32$ |
| | 320 | 13 | |
| | 318 | 10 | |
| | 317 | 4 | |
| | 315 | 2 | |
| | 314 | 3 | |
| | 311 | 1 | |
| | 309 | 1 | |
| | 308 | 1 | |
| | 305 | 1 | |
| Cu-A12A | 594 | 1 | $n = 41$ |
| | 590 | 1 | $\bar{X} = 586.2$ |
| | 587 | 1 | $\sigma = 8.85$ |
| | 585 | 14 | |
| | 580 | 6 | |
| | 575 | 11 | |
| | 565 | 3 | |
| | 562 | 2 | |
| | 557 | 2 | |
| Cu-A21B | 605 | 1 | $n = 41$ |
| | 598 | 6 | $\bar{X} = 586.2$ |
| | 595 | 3 | $\sigma = 8.85$ |
| | 593 | 1 | |
| | 590 | 2 | |
| | 587 | 11 | |
| | 585 | 4 | |
| | 582 | 3 | |
| | 577 | 3 | |
| | 575 | 5 | |
| | 568 | 1 | |
| | 565 | 1 | |

TABLE II. LECTROMAG DATA FOR COPPER-ON-STEEL

(All Measurements in Hundred-Thousandths Inch)

| Panel Number | Thickness X | Frequency | Statistical Data |
|---|---|---|---|
| Cu-A6A | * | * | * |
| Cu-A6B | * | * | * |
| Cu-A7A | 59 | 1 | $n = 41$ |
| | 57 | 6 | $\bar{X} = 54.3$ |
| | 56 | 4 | $\sigma = 2.06$ |
| | 55 | 10 | |
| | 54 | 3 | |
| | 53 | 10 | |
| | 52 | 3 | |
| | 51 | 2 | |
| | 50 | 2 | |
| Cu-A7B | 65 | 1 | $n = 41$ |
| | 64 | 5 | $\bar{X} = 60.2$ |
| | 62 | 2 | $\sigma = 2.26$ |
| | 61 | 7 | |
| | 60 | 13 | |
| | 59 | 8 | |
| | 58 | 1 | |
| | 57 | 2 | |
| | 55 | 1 | |
| | 54 | 1 | |
| Cu-A9A | 114 | 1 | $n = 41$ |
| | 112 | 2 | $\bar{X} = 106.8$ |
| | 110 | 3 | $\sigma = 2.71$ |
| | 108 | 16 | |
| | 105 | 15 | |
| | 102 | 4 | |
| Cu-A9B | 114 | 1 | $n = 41$ |
| | 110 | 3 | $\bar{X} = 105.1$ |
| | 108 | 7 | $\sigma = 2.86$ |
| | 105 | 17 | |
| | 102 | 13 | |
| Cu-A11B | 285 | 1 | $n = 41$ |
| | 276 | 2 | $\bar{X} = 266.2$ |
| | 275 | 3 | $\sigma = 5.19$ |
| | 267 | 16 | |
| | 264 | 3 | |
| | 262 | 15 | |
| | 260 | 1 | |
| Cu-A12B | 295 | 2 | $n = 41$ |
| | 285 | 20 | $\bar{X} = 281.4$ |
| | 280 | 2 | $\sigma = 5.55$ |
| | 278 | 1 | |
| | 276 | 15 | |
| | 268 | 1 | |
| Cu-A12A | 510 | 20 | $n = 41$ |
| | 490 | 21 | $\bar{X} = 499.8$ |
| | | | $\sigma = 9.99$ |
| Cu-A21B | 525 | 9 | $n = 41$ |
| | 520 | 7 | $\bar{X} = 515$ |
| | 510 | 25 | $\sigma = 6.44$ |

*Deposit too thin for Lectromag calibration.

TABLE III. GENERAL ELECTRIC THICKNESS GAGE DATA FOR COPPER-ON-STEEL

(All Measurements in Hundred-Thousandths Inch)

| Panel Number | Thickness X | Frequency | Statistical Data |
|---|---|---|---|
| Cu-A6A | 20 | 13 | $n = 41$ |
| | 19 | 15 | $\bar{X} = 18.8$ |
| | 18 | 7 | $\sigma = 1.22$ |
| | 17 | 2 | |
| | 16 | 4 | |
| Cu-A6B | 20 | 4 | $n = 41$ |
| | 19 | 18 | $\bar{X} = 18.2$ |
| | 18 | 8 | $\sigma = 1.27$ |
| | 17 | 5 | |
| | 16 | 5 | |
| | 15 | 1 | |
| Cu-A7A | 64 | 1 | $n = 41$ |
| | 63 | 3 | $\bar{X} = 58.9$ |
| | 62 | 11 | $\sigma = 3.68$ |
| | 61 | 5 | |
| | 60 | 5 | |
| | 58 | 3 | |
| | 57 | 1 | |
| | 56 | 1 | |
| | 55 | 1 | |
| | 54 | 3 | |
| | 53 | 7 | |
| Cu-A7B | 69 | 1 | $n = 41$ |
| | 68 | 2 | $\bar{X} = 64.4$ |
| | 67 | 5 | $\sigma = 2.35$ |
| | 66 | 3 | |
| | 65 | 13 | |
| | 64 | 9 | |
| | 63 | 1 | |
| | 62 | 2 | |
| | 60 | 4 | |
| | 58 | 1 | |
| Cu-A9A | 122 | 5 | $n = 41$ |
| | 120 | 16 | $\bar{X} = 116.4$ |
| | 116 | 6 | $\sigma = 5.16$ |

TABLE III. GENERAL ELECTRIC THICKNESS GAGE DATA FOR COPPER-ON-STEEL (*Continued*)
(All Measurements in Hundred-Thousandths Inch)

| Panel Number | Thickness X | Frequency | Statistical Data |
|---|---|---|---|
| | 115 | 2 | |
| | 113 | 4 | |
| | 112 | 1 | |
| | 110 | 1 | |
| | 108 | 3 | |
| | 106 | 3 | |
| Cu-A9B. . . . . | 124 | 2 | $n = 41$ |
| | 122 | 4 | $\bar{X} = 115.9$ |
| | 120 | 10 | $\sigma = 5.98$ |
| | 116 | 10 | |
| | 113 | 1 | |
| | 112 | 3 | |
| | 108 | 5 | |
| | 106 | 5 | |
| | 102 | 1 | |
| Cu-A11B. . . . . | 300 | 12 | $n = 41$ |
| | 295 | 23 | $\bar{X} = 294.6$ |
| | 290 | 1 | $\sigma = 5.88$ |
| | 285 | 3 | |
| | 275 | 2 | |
| Cu-A12B. . . . . | 329 | 2 | $n = 41$ |
| | 320 | 25 | $\bar{X} = 314.7$ |
| | 310 | 6 | $\sigma = 9.22$ |
| | 300 | 5 | |
| | 295 | 3 | |
| Cu-A12A. . . . . | 560 | 22 | $n = 41$ |
| | 545 | 15 | $\bar{X} = 550.7$ |
| | 525 | 3 | $\sigma = 12.12$ |
| | 510 | 1 | |
| Cu-A21B. . . . . | 580 | 23 | $n = 41$ |
| | 560 | 16 | $\bar{X} = 570.5$ |
| | 545 | 2 | $\sigma = 11.18$ |

TABLE IV. MICROSCOPIC DATA FOR COPPER-ON-STEEL
(All Measurements in Hundred-Thousandths Inch)

| Panel Number | Thickness X | Frequency | Statistical Data |
|---|---|---|---|
| Cu-A6A. . . . . | 13.2 | 4 | $n = 20$ |
| | 11.6 | 16 | $\bar{X} = 11.9$ |
| | | | $\sigma = 0.63$ |
| Cu-A6B. . . . . | 11.6 | 9 | $n = 20$ |
| | 9.9 | 10 | $\bar{X} = 10.6$ |
| | 8.3 | 1 | $\sigma = 1.0$ |
| Cu-A7A. . . . . | 56.3 | 1 | $n = 20$ |
| | 54.6 | 2 | $\bar{X} = 52.7$ |
| | 53.0 | 10 | $\sigma = 1.34$ |
| | 51.3 | 7 | |
| Cu-A7B. . . . . | 59.6 | 1 | $n = 20$ |
| | 57.9 | 10 | $\bar{X} = 57.0$ |
| | 56.3 | 6 | $\sigma = 1.34$ |
| | 54.6 | 3 | |
| Cu-A9A. . . . . | 108 | 4 | $n = 20$ |
| | 106 | 7 | $\bar{X} = 105.5$ |
| | 104 | 8 | $\sigma = 1.61$ |
| | 103 | 1 | |
| Cu-A9B. . . . . | 108 | 1 | $n = 20$ |
| | 106 | 4 | $\bar{X} = 104.5$ |
| | 104 | 12 | $\sigma = 1.26$ |
| | 103 | 3 | |
| Cu-A11B. . . . . | 285 | 2 | $n = 20$ |
| | 283 | 3 | $\bar{X} = 278.1$ |
| | 281 | 1 | $\sigma = 4.32$ |
| | 280 | 2 | |
| | 278 | 4 | |
| | 276 | 3 | |
| | 273 | 3 | |
| | 271 | 2 | |
| Cu-A12B. . . . . | 301 | 1 | $n = 20$ |
| | 296 | 2 | $\bar{X} = 292.5$ |
| | 295 | 3 | $\sigma = 3.20$ |
| | 293 | 5 | |
| | 291 | 3 | |
| | 290 | 3 | |
| | 288 | 3 | |
| Cu-A12A. . . . . | 571 | 1 | $n = 20$ |
| | 566 | 1 | $\bar{X} = 557.1$ |
| | 564 | 1 | $\sigma = 6.61$ |
| | 563 | 3 | |
| | 561 | 1 | |
| | 559 | 1 | |
| | 558 | 2 | |
| | 556 | 1 | |
| | 554 | 2 | |
| | 553 | 2 | |
| | 551 | 3 | |
| | 549 | 1 | |
| | 543 | 1 | |
| Cu-A21B. . . . . | 594 | 1 | $n = 20$ |
| | 592 | 2 | $\bar{X} = 579.5$ |
| | 591 | 1 | $\sigma = 9.60$ |
| | 589 | 1 | |
| | 586 | 2 | |
| | 584 | 1 | |
| | 583 | 1 | |
| | 581 | 1 | |
| | 579 | 1 | |
| | 578 | 1 | |
| | 576 | 1 | |
| | 573 | 1 | |
| | 571 | 2 | |
| | 568 | 2 | |
| | 564 | 1 | |
| | 563 | 1 | |

TABLE V. JET TEST DATA FOR COPPER-ON-STEEL
(All Measurements in Hundred-Thousandths Inch)

| Panel Number | Thickness X | Frequency | Statistical Data |
|---|---|---|---|
| Cu-A6A..... | 11.4 | 17 | n = 20 |
| | 9.1 | 3 | $\bar{X}$ = 11.1 |
| | | | $\sigma$ = 0.83 |
| Cu-A6B..... | 11.6 | 2 | n = 20 |
| | 11.4 | 6 | $\bar{X}$ = 10.1 |
| | 9.3 | 10 | $\sigma$ = 1.04 |
| | 9.1 | 2 | |
| Cu-A7A..... | 54.5 | 1 | n = 20 |
| | 52.3 | 10 | $\bar{X}$ = 50.7 |
| | 50.0 | 3 | $\sigma$ = 2.23 |
| | 47.6 | 6 | |
| Cu-A7B..... | 59.0 | 2 | n = 20 |
| | 55.8 | 4 | $\bar{X}$ = 54.5 |
| | 54.5 | 10 | $\sigma$ = 2.17 |
| | 51.1 | 4 | |
| Cu-A9A..... | 100.0 | 8 | n = 20 |
| | 97.6 | 2 | $\bar{X}$ = 96.0 |
| | 95.4 | 4 | $\sigma$ = 4.12 |
| | 93.0 | 3 | |
| | 88.3 | 3 | |
| Cu-A9B..... | 107 | 3 | n = 20 |
| | 102 | 10 | $\bar{X}$ = 101.2 |
| | 97.6 | 7 | $\sigma$ = 3.57 |
| Cu-A11B..... | 305 | 2 | n = 20 |
| | 300 | 3 | $\bar{X}$ = 290.0 |
| | 295 | 4 | $\sigma$ = 10.29 |
| | 290 | 3 | |
| | 288 | 1 | |
| | 285 | 2 | |
| | 280 | 1 | |
| | 278 | 1 | |
| | 276 | 1 | |
| | 273 | 1 | |
| | 268 | 1 | |
| Cu-A12B..... | 255 | 1 | n = 20 |
| | 243 | 1 | $\bar{X}$ = 234.4 |
| | 240 | 1 | $\sigma$ = 6.62 |
| | 239 | 2 | |
| | 236 | 2 | |
| | 235 | 2 | |
| | 232 | 5 | |
| | 231 | 2 | |
| | 228 | 3 | |
| | 224 | 1 | |
| Cu-A12A..... | 538 | 1 | n = 20 |
| | 533 | 2 | $\bar{X}$ = 508.6 |
| | 529 | 1 | $\sigma$ = 25.58 |
| | 524 | 3 | |
| | 519 | 4 | |
| | 514 | 3 | |
| | 510 | 2 | |
| | 470 | 1 | |
| | 458 | 1 | |
| | 455 | 1 | |
| | 447 | 1 | |
| Cu-A21B..... | 500 | 2 | n = 20 |
| | 491 | 1 | $\bar{X}$ = 477.1 |
| | 487 | 1 | $\sigma$ = 11.87 |
| | 483 | 3 | |
| | 479 | 3 | |
| | 475 | 4 | |
| | 472 | 1 | |
| | 464 | 1 | |
| | 463 | 1 | |
| | 460 | 2 | |
| | 458 | 1 | |

TABLE VI. STRIPPING DATA FOR COPPER-ON-STEEL
(All Measurements in Hundred-Thousandths Inch)

| Panel Number | Thickness X | Frequency | Statistical Data |
|---|---|---|---|
| Cu-A6A..... | 14 | 3 | n = 6 |
| | 13 | 3 | $\bar{X}$ = 13.5 |
| | | | $\sigma$ = 0.50 |
| Cu-A6B..... | 13 | 6 | n = 6 |
| | | | $\bar{X}$ = 13.0 |
| | | | $\sigma$ = 0 |
| Cu-A7A..... | 60 | 1 | n = 6 |
| | 59 | 4 | $\bar{X}$ = 59.0 |
| | 58 | 1 | $\sigma$ = 0.58 |
| Cu-A7B..... | 63 | 1 | n = 6 |
| | 62 | 2 | $\bar{X}$ = 61.7 |
| | 61 | 3 | $\sigma$ = 0.75 |
| Cu-A9A..... | 113 | 3 | n = 6 |
| | 112 | 2 | $\bar{X}$ = 112.2 |
| | 110 | 1 | $\sigma$ = 1.07 |
| Cu-A9B..... | 112 | 2 | n = 6 |
| | 111 | 3 | $\bar{X}$ = 111.2 |
| | 110 | 1 | $\sigma$ = 0.69 |
| Cu-A11B..... | 284 | 1 | n = 6 |
| | 280 | 1 | $\bar{X}$ = 279.0 |
| | 279 | 1 | $\sigma$ = 2.58 |
| | 278 | 1 | |
| | 277 | 1 | |
| | 276 | 1 | |
| Cu-A12B..... | 313 | 1 | n = 6 |
| | 308 | 1 | $\bar{X}$ = 308.0 |
| | 307 | 3 | $\sigma$ = 2.31 |
| | 306 | 1 | |
| Cu-A12A..... | 563 | 1 | n = 6 |
| | 560 | 1 | $\bar{X}$ = 554.7 |
| | 555 | 1 | $\sigma$ = 4.19 |
| | 554 | 2 | |
| | 542 | 1 | |
| Cu-A21B..... | 598 | 1 | n = 6 |
| | 585 | 1 | $\bar{X}$ = 584.2 |
| | 584 | 1 | $\sigma$ = 6.77 |
| | 582 | 1 | |
| | 579 | 1 | |
| | 577 | 1 | |

lated from the gain in weight of the cathode during the plating operation because there is only one measurement per panel and hence no frequency or other statistical data. The results for this method appear in Table VII.

A resume of the average-thickness determinations for each of the panels by seven methods is presented in Table VII. The percentage deviation of six of these methods with respect to results by the stripping method are shown in Table VIII, and in Table IX the standard deviations for these six methods are summarized. This table also contains in the last column the thickness results as determined by the stripping method, so that the standard deviation for any method of panel may be compared conveniently with the actual thickness.

Table VII indicates that all of the methods are reasonably acceptable so far as absolute measurements are concerned, except the microscopic, GE thickness gage, and BNF jet test for thicknesses below 0.0005 inch (13 $\mu$). The jet test is also unsatisfactory for thicknesses of 0.0025 inch (63 $\mu$) or greater. Table VIII may also be used in arriving at the same conclusions. If it is assumed that a percentage deviation of 10 per cent or more will disqualify a given test, the rejections mentioned above will be somewhat increased in number; e. g., the BNF jet test becomes acceptable only for the 0.001 inch (25 $\mu$) deposits.

If one examines Table VIII closely, it will be seen that the actual accuracy of some of the methods is not fully reflected in the tabulated results. Consider, for instance, the Magne-gage results. Every determination was higher than the results obtained in the stripping test. It is evident that if the gauge were to be re-calibrated in such a way as to lower uniformly the entire scale of results, the deviation could be made to fall lower than 10 per cent for every panel.

By the same token, if the Lectromag calibration were shifted in the opposite direction, the results for this instrument would be remarkably good—in fact, almost unbelievably so. The results of the BNF jet test would appear to better advantage if a re-calibration were undertaken, inasmuch as all of the panels except one gave results which are lower than the actual thickness. A calibration shift would not have helped the GE gauge results, and with the exception of the measurements on the thinnest panels, the results by this method are already very satisfactory.

It is interesting to examine the microscopic results from the same point of view. Here we are dealing with the absolute measurements which are made on the basis of a mechanical calibration which is known to be extremely accurate. It will be noted, however, that with one exception all of the deviations are in the same direction, i. e., the measurements are low

TABLE VII. AVERAGE THICKNESS OF ACID COPPER ON STEEL AS DETERMINED BY SEVEN METHODS

(All Measurements in Hundred-Thousandths Inch)

| Panel Number | Calculated | Stripping | Microscopic | Magne-gage | Lectromag | G. E. Gage | BNF Jet |
|---|---|---|---|---|---|---|---|
| A6A | 14 | 14 | 12 | 15 | * | 19 | 11 |
| A6B | 14 | 13 | 11 | 15 | * | 18 | 10 |
| A7A | 58 | 59 | 53 | 60 | 54 | 59 | 51 |
| A7B | 61 | 62 | 57 | 64 | 60 | 64 | 55 |
| A9A | 110 | 112 | 105 | 124 | 107 | 116 | 96 |
| A9B | 111 | 111 | 104 | 122 | 105 | 115 | 101 |
| A11B | 282 | 279 | 278 | 294 | 266 | 295 | 290 |
| A12B | 307 | 308 | 292 | 318 | 281 | 315 | 234 |
| A12A | 569 | 555 | 557 | 578 | 500 | 551 | 509 |
| A21B | 578 | 584 | 579 | 586 | 515 | 571 | 477 |

*Deposit too thin for Lectromag calibration

TABLE VIII. PER CENT DEVIATION FROM STRIPPING RESULTS*

| Panel Number | Calculated | Microscopic | Magne-gage | Lectromag | G. E. Gage | BNF Jet |
|---|---|---|---|---|---|---|
| A6A | 0.0 | −14.2 | + 7.1 | † | +35.6 | −21.4 |
| A6B | +7.7 | −15.4 | +15.4 | † | +38.4 | −23.1 |
| A7A | −1.7 | −10.2 | + 1.7 | − 8.5 | 0.0 | −13.5 |
| A7B | −1.6 | − 8.1 | + 3.2 | − 3.2 | + 3.2 | −11.3 |
| A9A | −1.8 | − 6.3 | +10.6 | − 4.5 | + 3.6 | − 5.4 |
| A9B | 0.0 | − 6.3 | + 9.9 | − 5.3 | + 3.6 | − 9.0 |
| A11B | +1.0 | − 0.4 | + 5.4 | − 4.7 | + 5.7 | + 3.9 |
| A12B | −0.3 | − 5.2 | + 3.3 | − 8.8 | + 2.3 | −24.0 |
| A12A | +2.5 | + 0.4 | + 4.2 | − 9.9 | − 0.7 | − 8.3 |
| A21B | −1.0 | − 0.9 | + 0.3 | −11.8 | − 2.2 | −18.3 |

*Plus signs indicate that a higher result was obtained compared to the stripping measurement; minus signs indicate the reverse situation.
†Deposit too thin for Lectromag calibration.

TABLE IX. STANDARD DEVIATIONS

(Hundred-Thousandths of an Inch)

| Panel Number | Stripping (n = 6)* | Microscopic (n = 20)* | Magne-gage (n = 41)* | Lectromag (n = 41)* | G. E. Gage (n = 41)* | BNF Jet (n = 20)* | Thickness by Stripping |
|---|---|---|---|---|---|---|---|
| A6A | 0.50 | 0.63 | 0.48 | † | 1.22 | 0.83 | 14 |
| A6B | 0.0 | 1.00 | 0.49 | † | 1.27 | 1.04 | 13 |
| A7A | 0.58 | 1.34 | 1.29 | 2.06 | 3.68 | 2.23 | 59 |
| A7B | 0.75 | 1.34 | 1.30 | 2.26 | 2.35 | 2.17 | 62 |
| A9A | 1.07 | 1.61 | 1.88 | 2.71 | 5.16 | 4.12 | 112 |
| A9B | 0.69 | 1.26 | 1.55 | 2.86 | 5.98 | 3.57 | 111 |
| A11B | 2.58 | 4.32 | 3.12 | 5.19 | 5.88 | 10.29 | 279 |
| A12B | 2.31 | 3.20 | 4.32 | 5.55 | 9.22 | 6.62 | 308 |
| A12A | 4.19 | 6.61 | 8.82 | 9.99 | 12.12 | 25.58 | 555 |
| A21B | 6.77 | 9.60 | 8.85 | 6.44 | 11.18 | 11.87 | 584 |

*n = the number of measurements per panel.
†Deposit too thin for Lectromag calibration.

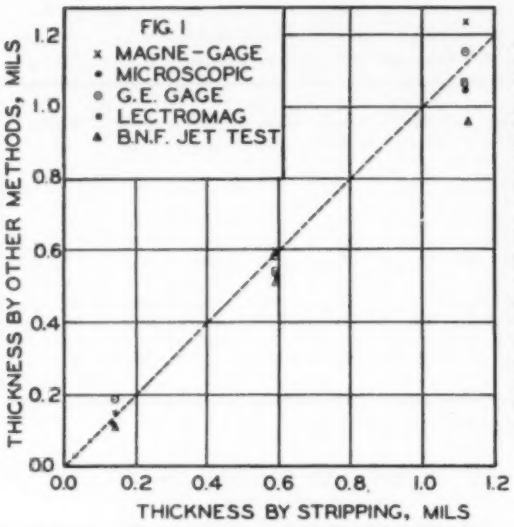



*Fig. 1. A comparison of thickness measurements by five methods with results from the stripping method. The dashed line represents perfect correlation*

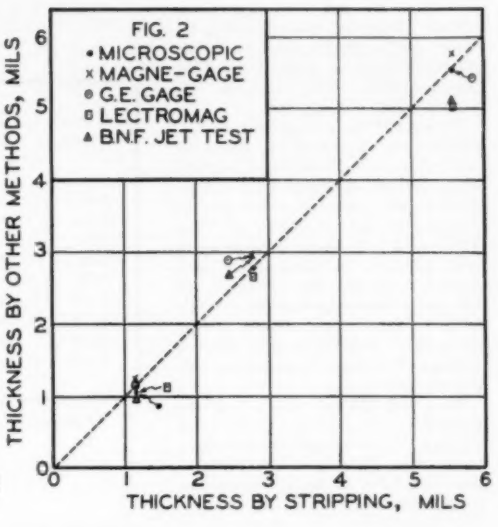



*Fig. 2. Same as Fig. 1 except for greater thickness. The points at the tails of the arrows are coincident with those indicated by the heads of the arrows*

compared to the stripping results. It is evident, therefore, that some factor or factors in the preparative procedure or the reading technique is introducing a systematic error, particularly in the thinner deposits. It is unlikely that the reading technique is at fault inasmuch as the absolute values compare very well with the stripping results for the thicker deposits. We must, therefore, fall back on the preparative procedure as a source of trouble. It has already been demonstrated by Read[8] that several metallographers will obtain divergent results on a single specimen, even though they are using presumably the same polishing technique. It has been the experience of others that the microscopic method is both difficult and unreliable for thicknesses below 0.0005 inch (13 $\mu$).

Figs. 1 and 2 permit a rapid visual comparison of the stripping results with the average values obtained with five of the other methods; the dashed line in each plot represents perfect correlation. These figures may be compared with Figs. 3 and 4 of the paper dealing with nickel on steel[3]. It will be seen that there is not much difference between the two sets of plots, except that the correlation for a nominal thickness of 0.001 inch (25 $\mu$) is not as good for copper as for nickel. No explanation can be offered for this divergence.

Table VIII not only indicates the necessity for the exact calibration of several of the methods against standards prepared in the same manner as the deposits to be measured, but it also points the way to a simple technique for making the standards that are required for the calibration. The first column of results shows that the calculated thicknesses derived from the gain in weight of the cathode during the plating operation are remarkably consistent with the thicknesses determined by stripping. The results on panel 6B are somewhat out of line with the others and may represent an error in weighing rather than a real deviation. In any case, it is evident that standard panels can be prepared by the simple technique described in this series of papers and that instruments calibrated against these panels will give reliable results in thickness determinations. It is also evident that almost any of the methods may be used within the minor limitations mentioned above. The plater may, therefore, adopt the method that is most easily applicable to the work at hand or that suits his laboratory equipment.

The reproducibility of the several methods is shown in Table IX. If it is assumed that a standard deviation which amounts to 5 per cent or less of the actual thickness represents an acceptable reproducibility, it is evident at once that, with a few exceptions, all of the methods are acceptable. These exceptions are the microscopic method and BNF jet test below 0.0005 inch (13 $\mu$) and the GE gage below 0.002 inch (50 $\mu$). It will be noted that the latter gage shows consistently higher standard deviations than either of the other two magnetic gages. The BNF jet test shows the most erratic behavior. It might well be that some experimental work on the solution used in this test would result in the discovery of a solution which would give results with copper equal to those obtained with nickel. The solution recommended by Clarke and used in the work reported herein appears to be somewhat too active for copper. No attempt was made to find a more satisfactory solution since the immediate objective of the work was to evaluate the methods that are now available and to use them in accordance with the best published directions.

The BNF jet test determinations were not all made at the same temperature, and the published curve for factor *versus* temperature was used to make the necessary corrections. Close examination of the results suggested the possibility that the published curve was not accurate for the copper used in this work. A brief investigation of the point was undertaken, and the results proved definitely that for the particular deposits tested (which were in no way unusual) the published curve is completely unsatisfactory. This makes it evident that the prospective user of the jet test for acid copper must not only determine his own factor for a particular type of deposit, but he must also determine the relationship between that factor and temperature. It is not sufficient to slide the curve along the factor axis to compensate for a different rate of reaction of the test solution with copper compared

(*Continued on page 958*)

# A. E. S. OFFICERS

## 1951-1952

**C. F. Nixon**
*President*

Born in Philadelphia, Pa., on May 4, 1901; graduated from the University of Wisconsin in 1923 with a B.S. in chemical engineering.

Employed in the laboratory of Western Electric Clock Company, Peru, Ill., for six years; since then with Ternstedt Division of General Motors Corporation, where he is now Director of Process Engineering.

Member of the American Electroplaters' Society since 1924; Past President of Detroit Branch. Contributed many papers on electroplating subjects and received several awards.

**Franklyn J. MacStoker**
*First Vice-President*

A native of Brooklyn, N. Y., attended elementary and high school in that city, and studied chemistry and metallurgy at Brooklyn Technical Institute and Cooper Union School of Science, New York City.

Electroplating Supervisor and Finishing Engineer with New York manufacturing concerns; travelling representative of Magnus Chemical Company, Brooklyn, N. Y., and Colonial Plating Equipment and Supply Company, Boston, Mass.; now Finishing Superintendent, Farrand Optical Corporation, Bronx, N. Y.

New York Branch A. E. S. member 1922; President 1928–1930, Secretary-Treasurer 1934 to date; member A. E. S. Award Committees 1930–1936; General Chairman, A. E. S. Silver Jubilee, New York City, 1937; A. E. S. First Vice-President 1938; member A. E. S. Research Committee 1940–1944, A. E. S. Constitution Revision Committee 1947–1948

**George P. Swift**
*Second Vice-President*

Born in Boston, Mass., on August 9, 1903; S.B., 1924, and S.M., 1928, in electrochemical engineering, ScD. in metallurgy, 1944, all from M. I. T.

Taught physics and metallurgy at M. I. T. 1924–1944; began independent consulting practice in 1930; since 1944 operates electrochemical and spectrographic laboratories in Watertown, Mass.; Director of Alice Ames, Inc., Boston; Executive Secretary, Master Metal Finishers' Association, since 1947.

Officer of Boston Branch, American Electroplaters' Society, since 1941; President 1942–1945; Assistant to Secretary-Treasurer, 1945–1946; Secretary-Treasurer, 1946– . Officer, Boston Section, and Director, A. I. M. E.; active in A. S. T. M. and other societies.

**William J. Neill**
*Past President*

Born on July 1, 1901; attended school in a great many cities due to his father's business. Franklin University is his alma mater.

General Superintendent of Columbus Metal Products Company, manufacturers of oil burner and truck and bus equipment.

Past President (two terms) of the Dayton Branch; instrumental in organizing the Columbus Branch. Member of American Institute of Chemists and Vice-Chairman of its Miami Valley Chapter; member of the Board of Governors of the Ohio Committee for Professional Practice; member and Post Officer of Kiwanis International; Chairman of the Subcommittee on Methods of Analysis of the Metal Finishing Industry Action Committee of the Ohio River Valley Water Sanitation Commission.

**Ralph A. Schaefer**
*Third Vice-President*

Born near Grafton, Ohio, on August 16, 1913; studied first at University of Notre Dame, then at Western Reserve University, which awarded him a B.S. degree in 1935, a M.S. degree in 1936 and a Ph.D. degree, in physical chemistry, in 1941.

With Cleveland Graphite Bronze Company, Cleveland, Ohio, since 1936; Director of Research since 1945. Known for fundamental work in the practical development of plated bearings and as author of many articles on related subjects.

Past President of the Cleveland Branch, A. E. S.; member A. E. S. Research Committee 1946–1949, Chairman of its Project No. 11, Research Supervisor 1950– ; Associate Editor of PLATING 1946– . Held many offices in the Electrochemical Society; active in A. S. T. M. and many other technical and scientific societies.

# BUFFALO CONVENTION A SUCCESS

That the A. E. S. Convention was to become successful was evident already on Sunday night, July 29, when over 400 registrations were in the files of Registration Chairman W. D. Hart. The final registration figure, 1358, broke all records.

### The Opening Session

Following a moving invocation by the Reverend Frank C. Mesle, a Past President of the Society (1926–1927) and a welcoming address by Mr. Bert Kirchhoff, Buffalo Branch President and the Convention's energetic General Chairman, the gavel was taken by A. E. S. President W. J. Neill. He announced the appointment of Dr. D. Gardner Foulke to succeed Dr. A. Kenneth Graham when he retires from the Executive Secretaryship following a training period of his successor, and introduced Mr. Walter L. Pinner, Chairman of the Metal Finishing Industry Action Committee of the Ohio River Valley Water Sanitation Commission and also a Past President of the A. E. S. (1945-1946). Mr. Pinner touched upon the work of the Committee and its close cooperation with A. E. S. Research Committee, and announced that the Commission had contributed $5,000.00 to the work of A. E. S. Project Committee No. 2 on "Analytical Procedures for Determining Ingredients of Wastes from Plating Plants" under Dr. Earl J. Serfass at Lehigh University. He also brought to the members' attention the committee's manual on "Plating Room Controls for Pollution Abatement", reviewed elsewhere in this issue.

The highlight of the session was the keynote address by Dr. William Blum, an honorary member of the Society. Speaking in a reminiscent mood about "Electrodeposition Researches at the National Bureau of Standards", Dr. Blum emphasized the necessity for research if the plating industry is to continue its growth.

### The Educational Program

The Editorial Board had arranged a largely "practical" program, and the attendance at the sessions and the lively discussions that followed the presentations of the papers testified to its usefulness and timeliness.

The topics for the five sessions were "Engineering Aspects of Electroplating", Mr. G. W. Jernstedt, Chairman; "Preparation and Plating of Zinc Base Diecastings", Dr. R. B. Saltonstall, Chairman; "Open Forum on Substitute Finishes for Electroplating", Dr. Walter R. Meyer, Chairman; "Some Practical Aspects of Plating Room Control", Mr. John Acheson, Chairman; and "Report on A. E. S. Research Program", Mr. Guy M. Cole, Chairman. Regrettably, none attempted to tell the secret of how to nickel plate without nickel; Drs. Wesley and Carr and Mr. Roehl, in their paper, "Nickel Plating with Insoluble Anodes", were found to put nickel anodes in an auxiliary tank.

### The Entertainment Program

The first event was the "Night of Food, Frolic and Fun" or "Open House" sponsored by the International Fellowship Club on Monday night, July 30. To quote the "H-VW-M Official Convention News", the paper in which the Hanson-Van Winkle-Munning Company, since 1935, each morning tells the Convention visitor what he and his fellows did the day before, "many acquaintanceships were renewed, many a back was red from the hearty slaps of old friends, and the expression 'long time no see' echoed back and forth across the room. The music was excellent and varied . . . and as the evening wore on, more and more couples thought themselves capable of dancing to the Latin American rhythm. . . . Fuel for the activities was amply supplied by an appetizing buffet supper, washed down with a wide variety of liquid refreshment". Lucky winners of U. S. Savings Bonds were Mr. Walter H. Prine, New York City; Mrs. Frank Tirendi, Waterbury, Conn.; Mrs. Austin Fletcher, Binghamton, N. Y.; Mr. Harold W. Faint, Chicago, Ill.

On Wednesday morning, August 1, the Club held its Annual Golf Tournament at Orchard Park Country Club. It was under the chairmanship of Mr. Al Clem of Pennsylvania Salt Manufacturing Co.

The Society is grateful for these and other contributions of the Club, news about which appears elsewhere in this report.

The Annual Picnic was held on Wednesday afternoon at the Automobile Club, Clarence, N. Y. Chairman Joseph Ruff and his committee had arranged a most delightful affair, and the *East* beat the *West* in the ball game. More news elsewhere.

The Banquet on Thursday night, August 2, crowned the entertainment program. A capacity crowd enjoyed the thick slabs of roast beef—the speeches were commendably short, consisting largely of introductions of Convention bigwigs—and the dancing continued until 1 o'clock, interrupted only by visits to the rooms of suppliers, this time of refreshments of all kinds.

### Ladies' Program

The ladies' activities will be covered in a separate report by one of the ladies who participated.

### Convention Business

The Delegates met on Thursday afternoon, August 2, to deal with the problems of the Society.

They passed without a dissenting vote the 1951–1952 Society Budget proposed by the Executive Board and presented by First Vice-President C. F. Nixon. Although this budget showed a substantial deficit, which will be difficult to meet with profits from this journal, the Delegates voted overwhelmingly, by 87 votes to 46, to defeat the Executive Board amendment to the Constitution and By-Laws to raise the *per capita tax* to $7.50, and it remains at its present level of $4.70. The amendment to the constitution and by-laws proposed by the Executive Board to eliminate the *per capita tax on student members* was passed unanimously.

According to custom, the members of the *Executive Board* were moved up one notch, no competing candidates being offered. However, three candidates were presented for the office of Third Vice-President, namely, Dr. R. A. Schaefer of the Cleveland Branch; Convention General Chairman Bert Kirchhoff of the Buffalo Branch; and Mr. R. J. Wooley of the Los Angeles Branch, who was to have been General Co-chairman had this Convention been held in Los Angeles. Dr Schaefer won the contest with a comfortable absolute majority and was then, on motion by Mr. Wooley, elected unanimously. The members of the new Executive Board are presented elsewhere in this issue.

New York City was chosen *Convention City* for 1954 without contest. Chicago is the site of the 1952 Convention, Philadelphia of the 1953 Convention.

### Honors and Awards

Mr. H. A. Gilbertson, during many years a pillar of strength within the A.E.S., was elected to *honorary membership* of the Society. He served the Chicago Branch in many capacities, including that of President, and was the Society's Secretary-Treasurer during 1930–1935 and its President during 1935–1936. He is an

expert in the field of precious-metal plating and has been a popular speaker on such subjects before Branches.

The awards of $50.00 for outstanding *Branch growth* during the past year were presented to the Grand Rapids, Montreal and Allentown-Reading Branches by Membership Chairman F. J. MacStoker.

The Committee on *Paper Awards*, consisting of Messrs. Henry Strow, Chairman, Leonard Chesworth and Milton Nadel, made the following awards:

A. E. S. Gold Medal and $50.00 to Dr. C. L. Faust, C. J. Slunder and A. E. I. Bearse for the article, "Ductile Mirror-bright Copper Plate from Acid Sulfate Baths".

A. E. S. Silver Medal and $25.00 to Dr. C. A. Zapffe and M. E. Haslem for the article, "Hydrogen Embrittlement in Nickel, Tin and Lead Electroplating".

Certificate of Honorable Mention and $15.00 to C. E. Reinhard for the paper, "Some Observations of the Microthrowing Power of Plating Solutions".

The Mechanical Finishing Award, sponsored by Lea Manufacturing Company and consisting of a certificate and $50.00, to H. Goldman for his paper, "Metal Finishing by Abrasive Tumbling".

The Chromium Plating Award, sponsored by Nutmeg Chrome Corporation and consisting of a certificate and $50.00, to Dr. J. E. Stareck, F. Passal and H. Mahlstedt for their paper, "Self-regulating High Speed Chromium Plating".

The Gold and Gold Alloy Plating Award, sponsored by Technic, Inc., was not bestowed this year in the absence of a suitable article or paper.

*Special greetings* were sent to three of the Society's most active members, namely Past President (1927–1928) and honorary member John H. Feeley, who has been physically incapacitated for well over a year; Mr. Myron B. Diggin, popular author and lecturer and an Associate Editor of PLATING, who recently underwent a critical operation; and Mr. David X. Clarin, first Chairman of A. E. S. Publicity Committee and active in the International Fellowship Club, who was on an extended boat trip at the insistence of his doctor.

*Dr. A. Kenneth Graham*, who will retire as Executive Secretary after his successor has been properly trained, was honored by the following resolution submitted by the Resolutions Committee, Past Presidents, S. S. Johnston, Chairman; George Wagner and E. J. Musick, and unanimously adopted by the Delegates with an ovation:

WHEREAS at Pittsburgh, in 1945, under the trying conditions of wartime restrictions and stresses and at a difficult period in the affairs of the Society, Dr. A. Kenneth Graham assumed the duties of Executive Secretary of the American Electroplaters' Society; and

WHEREAS for the six years intervening he has fulfilled those duties with an administrative skill from which the Society has gained steadily in numbers, in resources, in prestige, in influence, and in stature as a technical organization; and

WHEREAS we now learn with regret of his decision to relinquish his duties with the A. E. S. to devote his time and energies to pressing personal affairs; be it therefore

RESOLVED: that we of the American Electroplaters' Society, in Convention assembled, acknowledge to the devoted labors of our old friend Ken an indebtedness which we cannot hope ever to repay; that as we bid him God Speed in his official capacity we welcome him back with open arms to the ranks of his comrades; and that we wish him for many long years some portion at least of the robust health and full success which his constructive work in our interests has so richly earned.

### RESEARCH COMMITTEE ACTIVITIES

President Neill announced the following appointments to the Research Committee for the three-year period 1951-1954:

Julius Teres, Wright-Paterson AAA Base, Dayton, Ohio

R. F. Ledford, Hanson-Van Winkle-Munning Company, Chicago, Ill.

C. H. Sample, The International Nickel Company, New York City

They succeed Dr. W. A. Wesley of the International Nickel Company, Bayonne, N. J., retiring Chairman; Mr. H. J. Struckhoff, of Lasalco, Inc., St. Louis, Mo., retiring Vice-Chairman Finance; and Mr. N. E. Promisel, Bureau of Aeronautics, Navy Department, Washington, D. C., all of whom have served a full 3-year term with distinction.

The new Research Committee Chairman is Mr. Guy M. Cole of Ternstedt Division, General Motors Corporation, who last year served as Vice-Chairman, Research.

### A. E. S. SPECIFICATIONS

The procedure set forth on p. 765 of the July issue of PLATING was approved by the Delegates. According to this procedure the Executive Board will act on A. S. T. M. specifications on the recommendation and advice of a special committee consisting of the A. E. S. liaison member on A. S. T. M. Committee B-8 (Chairman) and those A. E. S. members who are also members of Committee B-8 Advisory Committee.

### THANKS

The Delegates passed a resolution of appreciation and thanks offered by the Resolutions Committee that, we are certain, all Convention visitors would have liked to second. It was directed to the following:

The Los Angeles Branch which had planned and organized a Convention on the West Coast that had to be postponed on account of the unsettled conditions

The Buffalo Branch which filled the breach and staged this successful convention

The authors of Convention papers

The management of the Statler and other Buffalo hotels and the Buffalo Convention Bureau

The International Fellowship Club

Oakite Products, Inc., for sponsorship of the Aunt Ella Society luncheon for the ladies

The Udylite Corporation for the ladies' technical session and luncheon

Hanson-Van Winkle-Munning Company for the Convention News

The suppliers and friends who contributed to the Convention fund, including those whose names appeared in the July and August issues of PLATING and below

Harold Day, William Fotheringham, Bush Brothers, Jamestown Electroplating Works, Plomb Tool Company, Behr Manning, and Crescent Tool Company for picnic prizes; Carborundum Company, Mentholatum Company, Behr Manning, McDougall Butler Company and Schaffner Manufacturing Company for favors; Barcalo Manufacturing Company for the Barcalouger; Detroit Chemical Specialties Company; Schaffner Manufacturing Company, J. J. Siefen Company, Wyandotte Chemicals Corporation and Green Electric Company for gifts to the ladies

All officers and committee members whose untiring efforts made the Convention a brilliant success

### ADDITIONAL CONVENTION FUND CONTRIBUTORS

The names of the following companies, not before available to us, should be added to the lists published in the July and August issues. The Society is grateful for their generous contributions.

Atlas Electro Plating Company, Buffalo, N. Y.

The Buffalo Plating Company, Buffalo, N. Y.

Bush Brothers, Olean, N. Y.

Chautauqua Plating Company, Falconer, N. Y.

Dulite Company, Middletown, Conn.

W. Green Electric Company, New York City

Jamestown Electro Plating Works, Jamestown, N. Y.

Keystone Chromium Corporation, Buffalo, N. Y.

Marlette Plating Company, Buffalo, N. Y.

McGean Chemical Company, Cleveland, Ohio

National Finishing Corporation, Buffalo, N. Y.

Platers Supply Company, Indianapolis, Ind.

(*Continued on page 958*)

*(1) At the Registration Desk: W. D. Hart (extreme right) in charge. (2) Dr. D. Gardner Foulke, Executive Secretary Appointee, acknowledges introduction at Opening Session. (3) General Chairman Bert Kirchhoff welcomes Convention. (4) Dr. William Blum delivers keynote address. A. E. S. President W. J. Neill at right.*

*(5) Monday afternoon speakers meet at luncheon to plan session. From left, Convention Educational Chairman Dr. C. J. Wernlund, E. A. Blount, C. Ciran, Session Chairman G. W. Jernstedt, D. Schantz, Stenotypist Florence Marquardt, R. J. Rominski, Mrs. and Dr. W. Blum, W. E. Stadel. (6) C. Wainwright of U. K. Scientific Mission chats with Plating's Editor, K. G. Soderberg. (7) From International Fellowship Club party Monday night. From left, clockwise: R. A. and Mrs. Woofter, F. Trudem, L. J. Schmitt, Mrs. Sternfels, Dr. L. E. Lancey, M. M. Sternfels, Dr. G. Dubpernell, J. M. Hosdowich. (8) The I. F. C. party in full swing*

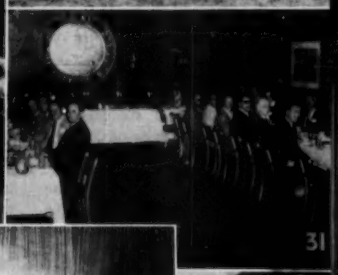
*(9) Educational Committee breakfast on Tuesday. From left: C. G. Borlet, Buffalo Branch Librarian Dr. A. A. Janis, Mrs. Wernlund, A. E. S. First Vice-President (now President) C. F. Nixon who delivered G. W. Beckwith's paper, Dr. C. J. Wernlund, A. E. S. Past President M. R. Caldwell, Session Chairman Dr. R. B. Saltonstall. (10) Large crowds attended the sessions*

*(11) The ladies travel to Niagara Falls. (12) S. J. Soplop, R. A. Wheeler and G. L. Dorough in serious discussion outside meeting room. (13) Philadelphians H. J. Orlik, J. B. Underwood, P. Mentzer, Sr., and G. Long relax between sessions. (14) Detroiters H. E. Head, P. H. Henning and L. S. Morse, Jr.*

*(15) Tuesday afternoon speakers prepare for session. From left: Dr. C. J. Wernlund, Miss Marquardt, B. J. Sherwood substituting for A. Douty, Dr. W. R. Meyer who also chairmanned the session, C. W. Ostrander, D. R. Meserve and A. W. Ackerman. (16) O. Olson, C. M. Boettcher, D. L. Ranson. (17) H. J. Struckhoff, Mrs. C. R. Wheeler, Mrs. B. Sage, B. Dow and C. R. Wheeler. (18) G. K. Robins registers for banquet with Picnic Chairman J. Ruff, Transportation Chairman L. Nowak and Banquet Chairman J. Moneypenny*

*(19) Table at National Association's Metal Finishers dinner on Tuesday night. From left, W. H. Hartzell, W. Westervelt, J. Lockerbie, R. Lindquist, C. Yerger, L. J. Schmill, Mrs. and Mr. A. Bregman. (20) Wednesday morning speakers at breakfast. Clockwise, from left: Dr. W. A. Wesley, Dr. C. J. Wernlund, E. J. Roehl, Session Chairman J. Acheson, J. B. Winters, C. Durbin. (21) Dr. E. A. Parker, A. S. Convey, F. W. Boothroyd, W. L. Cassell and J. F. Clarner*

*(22)–(30) At the picnic on Wednesday afternoon. (22) Mesdames F. Mentzer, Sr., J. B. Underwood, Bauman, H. J. Orlik in foreground. (23) H. A. Day, Dr. A. A. Janis and J. Moneypenny at their ball game. (24) Bean-bag throwers. (25) Chicagoans L. Hay, L. Glassner, Richard Giesel, Robert Giesel, H. E. DeGriener and J. R. Greenwell in back of their wives. (26) Baseball captains, and umpires with trophy. (27) The ball game in progress. (28) East's baseball team. (29) West's baseball team. (30) Nonathletic activities*




*(31) The Research Committee breakfast on Thursday morning. (32) The speakers at the Thursday morning session. From left, Dr. H. B. Linford, A. E. S. Past President E. T. Candee, Session Chairman G. M. Cole, Dr. D. Price*

*(33)–(37) From the business session on Thursday afternoon. (33) Executive Secretary Dr. A. K. Graham addresses the Delegates. (34) Past President H. A. Gilbertson receives honorary membership certificate from President W. J. Neill. (35) Past President C. A. Van Dereau thanks for honorary membership received last year and reminisces a bit. (36) Past President G. B. Hogaboom installs the new Executive Board: President C. F. Nixon; First Vice-President F. J. MacStoker, Second Vice-President Dr. G. P. Swift, Third Vice-President Dr. R. A. Schaefer and Past President W. J. Neill. (37) President C. F. Nixon wings the gavel that he has just received from retiring President W. J. Neill*

*(38) Dr. R. B. Saltonstall teaches electroplating on Thursday morning. (39) General Chairman Bert Kirchhoff welcomes the crowd to the banquet. (40) Carol Davis at banquet ready to draw the winning number for TV set won by H. J. LaCasse. (41) Mrs. Hanlon, L. E. Lougee and W. V. Coleman at banquet*

# A. E. S. Research

(*Continued from page 952*)

to the published data. The *shape* of the curve changes sufficiently that it must be redetermined in its entirety. This imposes a serious limitation on the test, inasmuch as calibration becomes a long and tedious operation.

The results reported herein appear to indicate, when considered along with those obtained for nickel on steel, that there is a greater need for an investigation of the reliability of standards prepared in a cathode box than for a further evaluation of the accuracy and reproducibility of the various test methods for other combinations of coatings and basis metals. The excellent results obtained for nickel and acid-copper by the authors and for silver and lead (all on steel) by Mohler and Schaefer[4] in the cathode box described by Mohler and Schaefer are, in a way, somewhat misleading, for it was found that very poor results were obtained in a cyanide-copper solution. This discovery led to an investigation of the utility of the cathode box for the preparation of standards from a variety of plating solutions. The results will be presented in the next paper of this series.

### Conclusions

Acceptable thickness standards for acid-copper on steel can be produced easily in a simple cathode box.

The reproducibility of the Magne-gage, GE thickness gage (Model A), Lectromag, BNF jet test, microscopic method and stripping method is acceptable for most purposes, except when the microscopic method at 500X and the BNF jet test are used for deposits of less than 0.0005 inch (13 $\mu$) and the GE thickness gauge (Model A) below 0.002 inch (50 $\mu$).

The absolute values obtained with the several methods are acceptable if the proper calibrations are used, except for the microscopic method, the GE thickness gauge, and the BNF jet test for thicknesses below 0.0005 inch (13 $\mu$). The jet test is also unsatisfactory for thicknesses of 0.0025 inch (63 $\mu$) or greater.

### Acknowledgment

The American Instrument Company, Silver Springs, Md.; The General Electric Company, Schenectady, N. Y.; and The Lea Manufacturing Company, Waterbury, Conn., kindly furnished the Magne-gage, GE Thickness Gage and Lectromag, respectively.

### References Cited

[1]H. J. Read and F. R. Lorenz, Plating **38**, 255–263 (1951).

[2]Instruction Book GEI-17421B, General Electric Company, Schenectady, N. Y., August 24, 1944.

[3]S. Lipson, Metal Finishing **43**, 412–414 (1945).

[4]"A. S. T. M. Manual on Presentation of Data", 1943 Reprint, American Society for Testing Materials, Philadelphia, Pa.

[5]H. J. Read, Proc. Am. Electroplaters' Soc. **34**, 135–145 (1947).

[6]J. B. Mohler and B. A. Schaefer, Mon. Rev. Am. Electroplaters' Soc. **34**, 1361–1364 (1947).

# Convention News

(*Continued from page 955*)

Roto-Finish Company, Kalamazoo Mich.
Speed Plating Works, Buffalo, N. Y.
Standard Plating Rack Company, Chicago, Ill.
Star Plating Works, Inc., Buffalo, N. Y.
Sterling Silver Plating Works, Inc., Buffalo, N. Y.
Tripp Plating Works, Inc., Buffalo, N. Y.
Utility Platers, Inc., Buffalo, N. Y.
Vick Plating Company, Buffalo, N. Y.

### The International Fellowship Club

Members of the Club chosen to represent their respective companies met on Monday afternoon, July 30, following the Club's Annual Luncheon, to act upon a number of recommendations by the Club officers.

It was agreed to change the name of the organization to Metal Finishing Suppliers Association, Inc., and to incorporate it as a non-profit association for mutual protection. The purpose of the new association is to promote the interests of the metal-finishing industry, to cooperate with technical organizations in the industry's field to promote mutual objectives, and "to coordinate efforts against duplication of activities and to minimize abuses such as the heretofore vague financial set-up of the (A. E. S.) Annual Convention and the repeated calls for financial support throughout the (A. E. S.) Branches".

The membership will consist of suppliers of materials, equipment and services to the metal-finishing industry, including jobbers, distributors and manufacturing agents. A member shall be a corporation, partnership, or proprietor, and shall have one vote exercised by a representative.

The Board of Directors will consist of the officers, the Past President and two Directors-at-Large. The officers elected at the meeting are:

*President*—A. P. Munning, of Munning & Munning, Inc., Newark, N. J.
*First Vice-President*—Al Braun, of Agate Lacquer Manufacturing Company, Long Island City, N. Y.
*Second Vice-President*—Charles Berry, of Maas & Waldstein Company, Chicago, Ill.
*Third Vice-President*—Manson Glover, of Glover Coating Company, Malden, Mass.
*Secretary-Treasurer*—T. H. Trumbour, of Finishing Publications, Inc., New York City

George L. Nankervis, of the George L. Nankervis Company, Detroit, Mich., is the immediate Past President. Pictures of all these gentlemen appeared in the July issue of Plating.

The association plans to raise operating funds in a fashion whereby the economically stronger members pay the larger dues, but the precise method of assessing and collecting dues has not yet been determined.

The annual meeting of the association will, as in the past, coincide with the A. E. S. Annual Convention.

The A. E. S., we are sure, welcomes the formation of this group as a voice of the suppliers.

### National Association of Metal Finishers, Inc.

This job-shop owners' organization held a dinner meeting on Tuesday night, July 31.

The main topic of discussion was the meeting of the recently formed Electroplating Industry Advisory Committee, on which the NAMF is heavily represented, with NPA officials on July 27 (see "Washington Orders").

Job platers are greatly concerned about getting more anodes and salts, especially of nickel, to permit them to stay in business; to get in on defense plating, which has proved very difficult for the small shop; and to prevent the granting of certificates of necessity for rapid tax amortization to manufacturing plants in areas where job shops operate substantially below capacity. They hope that the new Advisory Committee will be able to assist in these respects.

---

# Washington Orders

(*Continued from page 940*)

*Tin.*—The amendment to Order M-8 dated July 26 corrects certain typographical errors.

*Waste Disposal.*—The NPA, on July 18, created a Water Resources Division under Harvey S. Howe, Director, and James C. Crewshaw, Assistant Director. It will prepare programs to assure adequate supply of water and sewage services to support defense and essential civilian activities, and will distribute allotments of materials, supplies and equipment therefor.

*Zinc.*—The zinc distribution order M-9, was amended on July 5 to require all large users to obtain allocation certificates from the NPA. A user whose total receipts in any month is 20 short tons or less and who has not applied for an allocation authorization for that month obtains his zinc by means of a signed certification to the supplier.

August allocations were, in some cases, less than permitted use, forcing users to draw on inventory. Requests for allocation were about double the 70,000 tons distributed.

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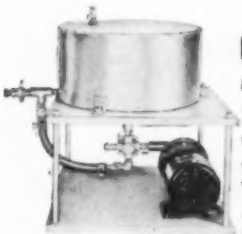

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# QUESTION BOX

## readers' questions of general interest

*Q. 122. What are the principal substitutes for nickel in decorative electroplating of steel in the U. S.?*

*A.* Steel is (1) copper plated and buffed (PR copper is also used without buffing), chromium plated to a minimum thickness of 0.00001-inch, and given a coating of a good grade of baked phenolic clear lacquer or (2) bright-zinc plated, further brightened by a proprietary brightening treatment, and given a coating of a good-grade of baked phenolic clear lacquer. Where the white-metal color is not essential the steel is (3) phosphate-coated and painted or (4) black-oxide coated and finished with a clear lacquer of good quality.—A. K. GRAHAM.

*Q. 123. In depositing 0.030-inch chromium on a low-alloy steel we have difficulty in avoiding the formation of pits. What would you suggest?*

*A.* We use 10-min electropolishing of SAE 5210 steel in a solution of 50 per cent (by vol) of each sulfuric and phosphoric acid at 2 asi to remove any inclusions that may cause pitting during subsequent chromium plating. It also gives a finer etch than the usual reverse-current chromic acid treatment and, at chromium thicknesses above 0.010 inch, a smoother deposit.—S. J. BEYER.

*Q. 124. We should like to reduce the amount of grinding required on heavy chromium plate by the use of electropolishing. What electropolishing solution would you suggest?*

*A.* It has been stated that chromium can be brightened by electropolishing in phosphoric-sulfuric acid solutions, presumably of concentrations and at operating conditions similar to those used in polishing stainless steels, or in solutions of 10–30 per cent sulfuric acid and 30–40 per cent citric acid (by wt) at 190° F and 10 asf. However, it is agreed that the electroplating brings out the crack lines encountered in "porous" chromium. The machinable chromium deposits produced by Gardam at 185° F and 200 asf from solutions containing 33 oz/gal chromic acid, 0.33 oz/gal sulfuric acid and 3.3 oz/gal iron (added as ferrous carbonate, about 7 ox/gal $FeCO_3$ or about 8 oz/gal $FeCO_3.H_2O$) are less likely to crack than the usual chromium deposits, but they are soft and the rate of deposition is only 0.4 mil/hr; at 400 asf, the rate is about 1 mil/hr and the hardness somewhat higher.—K. G. SODERBERG.

# Book Review

DR. HAROLD J. READ

*Associate Professor of Metallurgy, Pennsylvania State College*

PAINT TESTING INSTRUMENTS by L. A. Cooper, 72 pages, 1950. Sawell Publications Limited, Ludgate Circus, London, E.C. 4. Price, 7 shillings, 6 pence.

This booklet is based on a series of articles prepared for the British journal, *Product Finishing*, of which the author is technical editor. It consists primarily of more or less detailed descriptions of the construction and operation of paint-testing instruments, and contains but little information on the fundamental phenomena or theoretical considerations upon which the operation of each instrument depends. Such information, where it does appear, is limited to definitions and explanations of the properties which can be measured with certain instruments, particularly those designed for the determination of consistency, viscosity, gloss, color and covering power. The booklet can, however, serve as an excellent supplement to more fundamental discussions of paint-testing procedures, such as may be found in Vol. V of Mattiello's "Protective and Decorative Coatings" (reviewed in *The Monthly Review of the American Electroplaters' Society* **34**, 349 (March, 1947)).

Although this is a British book, many of the instruments which are described are made in the United States, and others of British manufacture are readily available in this country through American representatives. In almost every instance, each reference in the text to a specific instrument is accompanied by the name of the manufacturer whose address may be found in a list in the front of the book. It is unfortunate, however, that the list does not include American representatives of the British firms.

The text is divided into four main parts, each of which covers instruments for a specific class of tests: (a) consistency and viscosity, (b) gloss, color, and covering power, (c) wet tests, and (d) paint-performance tests. Within this well-organized framework, the descriptions of the individual instruments are lucid and sufficiently lengthy to give the reader an adequate picture of their construction and mode of operation. Line drawings and halftones are used profusely to supplement the text. In addition to the purely descriptive presentation, there are often fairly extensive critical remarks on the advantages and disadvantages of an instrument. In many instances, several instruments designed for the same or approximately the same purpose are available, and the critical remarks on each of them will assist a prospective purchaser in arriving at a wise choice.

Coverage of the field appears to be reasonably complete and includes the most modern instruments as well as those of well-established use.

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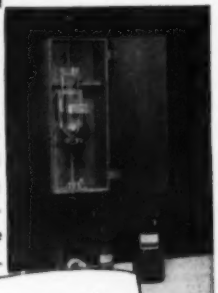

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# Patent Abstracts

GEORGE B. HOGABOOM
*Consultant, New Britain, Conn.*

**Copies of patents may be obtained by writing to Commissioner of Patents, Washington 25, D.C. Price 25 cents each.**

*No. 2,549,610, April 17, 1951—Method of Electroplating—J. M. Kennedy; H. J. Lee; Arthur P. Knight (deceased) by Norine R. Knight, executrix, and A. P. Knight, assignors to Revere Copper and Brass Incorporated.*

CLAIM 1. The method of electrodepositing on the bottom and continuous lower side-wall exterior surface of revolution of a cooking vessel a copper coating which on the side-wall surface is of progressively decreasing thickness as its upper edge portion is approached and merges at its upper edge into said surface, which method comprises electrodepositing the coating in successive steps, each for electrodepositing a thin layer of copper on said surface, by immersing only the bottom and lower side-wall portions of the vessel in an electrolyte with its bottom opposed to an anode and with its axis positioned vertically, progressively decreasing the depth of immersion of the vessel for said steps, during each step axially rotating the vessel for drawing a film of electrolyte up the side-wall surface above the level of the contiguous electrolyte a distance which is greater than the decrease in the depth of immersion of the vessel from the immediately preceding step and is less than the total decrease in immersion for the total number of steps, whereby the portions of copper layers electrodeposited on the portions of the side walls in contact with said films during successive steps overlap, as do likewise the portions of said layers electrodeposited on the portion of said layers electrodeposited on the portion of said side walls below said films, with the upper edges of those portions of said layers at progressively decreasing distances from the bottom of the vessel.

CLAIM 2. The method according to Claim 1 in which the anode is positioned below the bottom of the

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## Patent Abstracts

vessel approximately at the same distance for each step.

2 claims, 23 figures.

*References cited*: U. S. Patents 1,298,155; 1,335,176; 1,772,074; 2,138,938; 2,363,973.

*No. 2,549,737, April 17, 1951—Method of Electropolishing—Harold J. Wiesner, assignor to C. G. Conn Ltd., Elkhart, Ind.*

CLAIM 2. The method of polishing alloys in which copper is the major constituent which comprises connecting the alloy to be polished as an anode in an aqueous bath consisting essentially of a solution of tripolyphosphate of an alkali metal and a material selected from the group consisting of boric acid, boric acid salts and salts of carbonic acid, maintaining the *p*H of the bath in the range from 7.0 to 8.5 and operating the bath at a temperature between 100 and 212° F and at a current density in excess of 100 amperes per square foot.

3 claims, 4 examples.

*References cited:* U. S. Patents 2,086,867; 2,226,384; 2,244,158; 2,294,227; 2,330,170; 2,428,141. British Patent 435,710.

*No. 2,549,946, April 24, 1951—Electropolishing—M. A. Treuhaft and C. E. Swanson, assignors to Hudson Chemical Company, Hoboken, N. J.*

We have found that (heretofore) when the part to be polished electrolytically is made the anode in a chemical bath, bubbles collect on the surface of the anode and may cling to this surface very tenaciously. The bubbles sometimes remain in more or less fixed positions during the electrolytic polishing process, and because they affect the current they cause irregularities corresponding to their positions to appear on the surface of the metal.

It is an important object of this invention to provide a means for eliminating the bubbles. . . . The means is to apply mechanical wiping to the surface of the anode, while subjecting the objects to an electric current in the presence of a viscous electrolyte.

CLAIM. An improved method of electro-buffing metal, which comprises establishing a circulating bath of an electrolyte of a type which electrolytically removes metal from an anode with continuous production of a by-product film on the anode surface, immersing a metal object as anode in said bath with its surface which is to be electro-buffed under the surface thereof and facing into a free portion of the bath to provide electrolyte circulation space across said surface, connecting and maintaining in the same circuit a cathode, wiping the high areas of the surface being electro-buffed with physically separated wipers, continuously circulating electrolyte between said wipers, said wiping occurring only at a plurality of separated areas at any one instant, continually shifting the wipers relative to the surface being electro-

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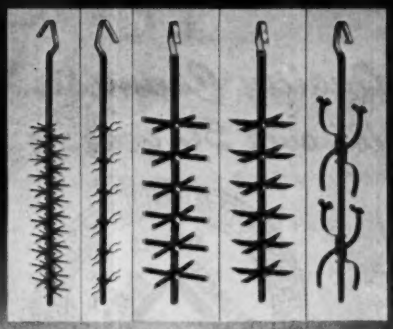

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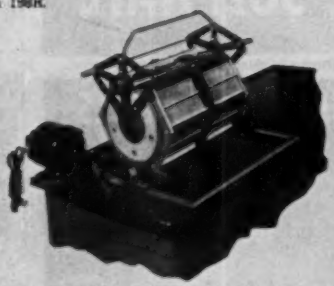
**BELKE Permanent Tank Magnet**—Recovers iron and steel pieces from bottom of plating tanks and barrels with minimum effort. Write for Bulletin 196R.

**BELKE Rubberite Tank Lining** — Unaffected by acids and caustics at room temperature. Easy to apply. Write for Bulletin 851.

**BELKE Rod Agitators for Plating Tanks**—A necessity for good bright nickel plating. Recommended for plating die castings. Produces more uniform deposits. Write for Bulletin 193.



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## *Patent Abstracts*

buffed so that all such high areas on such surface are wiped, but the wiping of individual areas thereon is intermittent, the area of the immersed surface which is undergoing electro-buffing being substantially in excess of the portion of that area which is being wiped at any one time, whereby to allow the electrolyte to act on each area between said intermittent wipings, and continuing the wiping and free exposure to circulating bath and the maintaining of the by-product film on the low areas thereof until minute high areas in which surface irregularities had existed are brought to a surface substantially codirectional and contiguous with adjacent surface areas to form a distinct-image-reflecting surface.

1 claim, 8 figures.

*References cited:* U. S. Patents 398,045; 2,412,186. French Patent 921,192. Trans. Electrochem. Soc. **82**, 227–230 (1942). Monthly Rev. Am. Electroplaters' Soc. **34**, 942, 943 (August, 1947). Bibliography of Scientific and Industrial Reports **1**, No. 9, 304 (March 8, 1946).

*No. 2,550,388, April 24, 1951—Surface Treatment of Aluminum and Aluminum Alloys—Eli Simon and T. G. Carasso, assignors to Lockheed Aircraft Corporation.*

CLAIM 2. In a process of producing thick, porous, absorbent oxide coatings on aluminum suitable for dyeing, the steps comprising using the article to be treated as the anode in an electrolytic cell, the electrolyte of which contains 10 to 20 per cent by volume sulfuric acid and 0.1 per cent by volume of a non-ionic wetting agent consisting of iso-octyl species of alkylated polyethoxy ethanols, the temperature of said electrolyte ranging from 60° to 100° F, and impressing an electric current having an operating voltage of approximately fourteen volts and a current density of the order of from one to twenty amperes per square foot of surface on said electrolytic cell for a period ranging from ten to thirty minutes.

2 claims.

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1— 600 A., 24 V. Reliance
1— 200 A., 25 V. Star
1— 300 A., 25 V. Star
1— 175 A., 25 V. Gr. Wh.

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1— 500 A., 32 V. Columbia
2— 100 A., 30 V. Gen. Elec.
1— 200 A., 30 V. West.
2— 200 A., 32 V. Gen. Elec.
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2—1000 A., 40 V. Chandeysson
2— 200 A., 42 V. Gen. Elec.
3—1500 A., 45 V. Century
1—1500 A., 50 V. Gen. Elec.
2— 800 A., 50 V. Gen. Elec.
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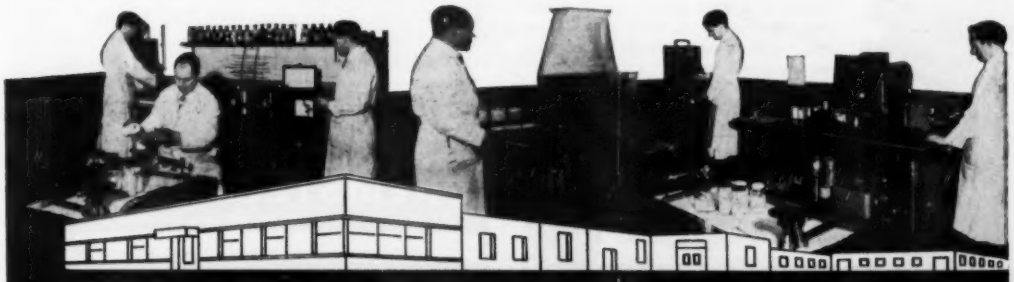

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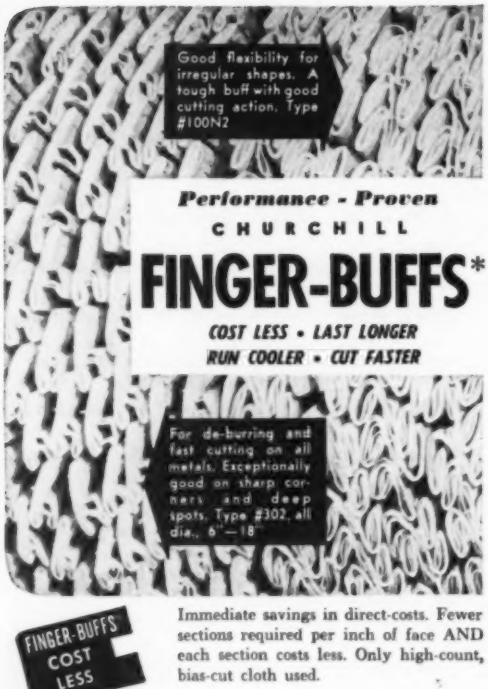
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## *Patent Abstracts*

*References cited:* U. S. Patents 2,279,252; 2,320,999; 2,376,082. Swiss Patent 176,945. U. S. Patent Appl. Ser. No. 369,618, Sassetti *et al.* (A. P. C.) published May 18, 1943. Ind. Eng. Chem. **33**, 11–22 (January, 1941). Young and Coons, "Surface Active Substances" (1945) p. 110. Chem. Inds. **52**, 326–328 (March, 1943).

*No. 2,550,449, April 24, 1951—Electrodeposition of Nickel from an Acid Bath—Henry Brown, assignor to The Udylite Corporation.*

CLAIM 2. The method of electrodepositing bright nickel comprising the step of electrodepositing bright nickel from an aqueous acid solution of a material selected from the group consisting essentially of nickel chloride, nickel sulfate, a mixture of nickel sulfate and nickel chloride, a mixture of nickel fluoborate and nickel chloride, a mixture of nickel fluoborate and nickel sulfate, and a mixture of nickel sulfate, nickel chloride, and nickel fluoborate, said solution also containing in a concentration falling within a range of from about 0.1 gram per liter to saturation an organic compound soluble in the solution and selected from the group consisting of allyl sulfonic acids, allyl and vinyl sulfonamides and sulfonimides, said solution also containing in a concentration falling within a range of from about 0.001 gram per liter to 0.02 gram per liter a compound selected from the group consisting of N-aliphatic pyridinium pyrazoles and N-aliphatic quinolinium pyrazoles, the N-aliphatic group containing from 1 to 8 carbon atoms, said bath having a *p*H of from about 1 to 6.

2 claims, 3 tables, 3 examples.

*References cited:* U. S. Patents 2,029,387; 2,191,813; 2,198,267; 2,255,057; 2,315,802; 2,427,280; 2,513,280; 2,523,190; 2,523,191. Metal Ind. (London) **63**, 231 (November 24, 1944). "Modern Electroplating" (1942) pp. 242, 243. Davis *et al.*, Ind. Eng. Chem. **33**, 1546, 1547 (1941). Frank C. Whitmore, "Organic Chemistry" (1937) pp. 902, 941, 943, 944, 948, 951, 952.

*No. 2,550,544, April 24, 1951—Method of Anodically*


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## Patent Abstracts

*Polishing Aluminum—C. L. Faust, assignor to Battelle Development Corporation.*

CLAIM 3. A method of electropolishing aluminum and aluminum alloys containing at least 90 per cent aluminum and not over 1 per cent silicon, which comprises making said aluminum the anode in a composition initially comprising essentially from 4 to 45 per cent by weight of sulfuric acid, and from 40 to 80 per cent by weight of phosphoric acid, and from 0.2 per cent by weight to saturation of chromic acid, maintaining an amount of dissolved aluminum such that the total amount of dissolved aluminum and trivalent chromium during continued operation is not in excess of 6 per cent by weight, the balance being essentially water and the total acid concentration being 50 to 95 per cent by weight, and passing a current through said electrolyte at an anodic current density of from 60 to 150 amperes per square foot, at a temperature of from 160 to 190° F, and a voltage of from 7 to 15 volts, and adding water as necessary to said composition to maintain said composition during said electropolishing at a viscosity of from 9 to 13 centipoises as measured at operating temperature.

3 claims, 9 figures.

*References cited:* U. S. Patents 2,040,617; 2,333,321; 2,366,714; 2,429,676. Proc. Am. Electroplaters' Soc. 33, 50–51, 67 (1946).

*No. 2,551,413, May 1, 1951—Method of Producing Silver-Thallium-Indium Alloys—J. M. Booe, assignor to P. R. Mallory & Co., Inc.*

CLAIM 1. The method of forming a bearing alloy which comprises electroplating successive layers of indium, thallium and indium over a silver base and subjecting the resulting combination to heat treatment for about 6 to 12 hours at a temperature of about 500 to 600° C (930–1110° F) to cause diffusion of thallium and indium into silver and the formation of a thallium-indium-silver alloy.

*References cited:* U. S. Patents 2,086,841; 2,375,224; 2,379,434; 2,379,435; 2,393,905. Hensel, "Silver-Thal-

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## *Patent Abstracts*

lium Antifriction Alloys", Metals Technol., Tech. Pub. No. 1930, 1–14 (October, 1945).

*No. 2,552,920 May 15, 1951—Electrolytic Tin Plating Bath—William S. Allen, assignor to United States Steel Corporation.*

CLAIM 1. An electrolytic tin plating bath consisting essentially of an aqueous acid solution, having a maximum *p*H value of 2, of 10 to 80 grams per liter of tin in the form of a stannous salt of an acid of the group consisting of sulfuric acid, phenolsulfonic acid and hydrofluoric acid and 0.2 to 7.0 grams per liter of an addition agent which is a polymer of a monomer of the group consisting of 2, 2, 4-trimethyl-1, 2-dihydroquinoline, 2, 2, 4, 8-tetramethyl-1, 2-dihydroquinodine, 2, 2, 4, 7-tetramethyl-1, 2-dihydroquinoline, 2, 2, 14, 6-tetramethyl-1, 2-dihydroquinoline, 2-methyl-2, 4-diethyl-1, 2-dihydroquinoline, and 2, 6-dimethyl-2, 4-diethyl-1, 2-dihydroquinoline.

8 claims, 9 examples.

*References cited:* U. S. Patents 1,824,100; 2,370,936. Kern, Trans, Electrochem. Soc. 33, 155–168 (1918); 38, 148 (1920).

*No. 2,555,372, June 5, 1951—Method of Coating Refractory, Readily Oxidizable Metals—John H. Ramage, assignor to Westinghouse Electric Corporation.*

CLAIM 3. The method of protecting against oxidation at high temperatures articles constructed of metal selected from the group consisting of molybdenum, tungsten, tantalum, zirconium, thorium, uranium and refractory but readily oxidizable alloys thereof, comprising electroplating them with chromium, covering said plated articles with powdered chromium, and heating in hydrogen at a temperature of about 1100° C (2010° F) to obtain a firmly adherent coating of chromium thereon.

3 claims, 3 figures.

*References cited:* U. S. Patents 1,365,499; 1,590,101; 1,899,569; 2,304,297. "Protective Coatings for Metals" (ACS Monograph 79) (1939), p. 185.


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# A. E. S. News

### Dr. Foulke to be Executive Secretary

Dr. D. Gardner Foulke, according to announcement made at the Buffalo Convention, after a period of training under Dr. A. Kenneth Graham, resigned, will take over the Executive Secretaryship.

Dr. Foulke was born on August 19, 1912, and received his education at Juanita College (B.S. in Chemistry, 1934), Rutgers University (M.S., 1937; Ph.D., 1941), and University of Munich (1937).

Following periods as Instructor at Rutgers University and Polytechnic Institute of Brooklyn and Assistant Professor at Beaver College, he did research at the Eastern Regional Research Laboratory of the Department of Agriculture and with A. Kenneth Graham & Associates. He then became Assistant Chief Chemist at the Warren, Ohio, plant of Republic Steel Company; Chief Chemist of the Garfield Division, Houdaille-Hershey Corporation; Director of the Analytical Laboratory of Foster D. Snell, Inc., and Process Electrochemist to Chief Chemist in charge of analysis and customer service, of Hanson-Van Winkle-Munning Company.

Dr. Foulke has published papers on anodizing of aluminum and on analysis of traces of impurities in plating solutions. For the latter he received the A. E. S. Gold Medal in 1945. He has been chairman of A. E. S. Research Project Committee No. 2 since 1946.

We welcome him to his new post.

### Texas Branches to be Chartered

The Executive Board, at its meeting on August 3, passed a motion to grant permanent charters to the Houston and Dallas-Fort Worth Branches.

The charter presentations will take place no earlier than October. Past President William J. Neill will represent the Board on these occasions.

### Branch Speakers List

The following should be added to the Branch Speakers List published in the August issue.

GRAVER WATER CONDITIONING COMPANY (c)
216 W. 14th St., New York 11, N.Y.
MARVIN LANE, Chemist
Subject:
*Water Treatment*

### Guy Cole Passes Away

Guy M. Cole, of the Ternstedt Division, General Motors Corporation, Detroit, and newly elected Chairman of A. E. S. Research Committee, died after a short illness on August 10. His passing is a great loss to the Society.


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1—6000/3000 AMP, 6/12 VOLT, **BOGUE.** Synchronous Motor. Separately Excited.

1—5000/2500 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Synchronous Motor. Separately Excited.

1—5000/2500 AMPERE, 6/12 VOLT, **EAGER ELECTRIC CO.** Separately Excited.

1—3000/1500 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Synchronous Motor. Exciter-in-Head.

1—2000/1000 AMPERE, 6/12 VOLT, **A. P. MUNNING** "OPTIMUS."

1—1500/750 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.**

1—1000/500 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS CO.** Separately Excited.

1—2000 AMPERE, 50 VOLT, **CHANDEYSSON ELECTRIC CO.** ANODIZER. Synchronous Motor. Exciter-in-Head.

2—1000 AMPERE, 30 VOLT, **IDEAL** ANODIZERS. Exciter-in-Head.

1—1000 AMPERE, 40 VOLT, **CHANDEYSSON ELECTRIC CO.** ANODIZER. Synchronous Motor. Exciter-in-Head.

2—500 AMPERE, 40 VOLT, **"M. G. C."** ANODIZERS. Separately Excited.

5—**GREEN SELECTROPLATERS,** 1800 AMPERES, 12 VOLTS, for 220/3/60 A.C.

1—**GENERAL ELECTRIC CO.** COPPER OXIDE RECTIFIER, 2000 AMPERES, 6 VOLTS, for 220/3/60 A.C.

2—**UDYLITE-MALLORY** RECTIFIERS, 1440/720 AMPERES, 6/12 VOLTS, for 220/440/3/60 A.C.

4—**GENERAL ELECTRIC** COPPER OXIDE RECTIFIERS, 500 AMPERES, 6 VOLTS, for 220/3/60 A.C.

1—USED **UDYLITE** SEMI-AUTOMATIC KOROSEAL-LINED PLATING MACHINE. 19' x 61" x 54".

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**M. E. BAKER CO.**

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# ZINC PLATING

## *For ULTIMATE BRILLIANCE And Best Results*

## *Use* ROHCO PRODUCTS!

### ROHCO 100 AND 303 ZINC BRIGHTENERS

ROHCO 100 Barrel Brightener imparts brilliance to zinc plating that is almost unbelievable until observed. It exhibits high covering power so that recesses, usually unplated, are easily covered with a substantial thickness of deposit. ROHCO 303 Still Brightener gives unusually bright deposits that offer ideal surfaces for bright dipping to even greater lustre or for conversion coatings by chromic acid treatment. Minimizes consumption of bright dips. Also exhibits high covering power so that recesses are easily plated. The cost of ROHCO 100 and ROHCO 303 is far less than would be anticipated for the many advantages realized in uniformly highest quality, maximum production, and minimum labor costs.

### ROHCO ZINC PURIFIER

ROHCO Zinc Purifier keeps heavy metals precipitated and harmless to the bath. Used in the amount of only one pint per 500 gallons per day, either barrel or still, it minimizes consumption of zinc brighteners. Its cost is almost negligible.

### ROHCO NO-FLASH

ROHCO No-Flash is used principally for barrel plating but may also be used for still plating. At a cost that is negligible, this product eliminates the hazard and nuisance resulting from gas explosions in zinc plating.

ROHCO

**ROHCO PRODUCTS**

NO-CRO-MIST • HULL CELL TEST • ROHCO 20XL CADIUM BRIGHTENER ROHCO 100 BARREL AND 303 STILL ZINC BRIGHTENERS • RINS-AID • CRŌMETER

**R. O. HULL & CO., INC.**

**1302 Parsons Court**
**Rocky River 16, Ohio**

*Canada:* Armalite Company, Ltd.
Toronto 6, Canada

*"YOUR PLATING IS BEST WITH THE HULL CELL TEST"*

**JUST PIN THIS COUPON TO YOUR LETTERHEAD!**

R. O. HULL & CO., INC.
1302 Parsons Court
Rocky River 16, Ohio

Gentlemen:

**SEND** .....Gal., Liquid, ROHCO 100 BARREL ZINC BRIGHTENER
.....Gal., Liquid, ROHCO 303 STILL ZINC BRIGHTENER
.....Gal., Liquid, ROHCO ZINC PURIFIER
.....Lbs., Powder, ROHCO NO-FLASH

Name.....

Company.....

Street Address.....

City.....Zone.....State.....



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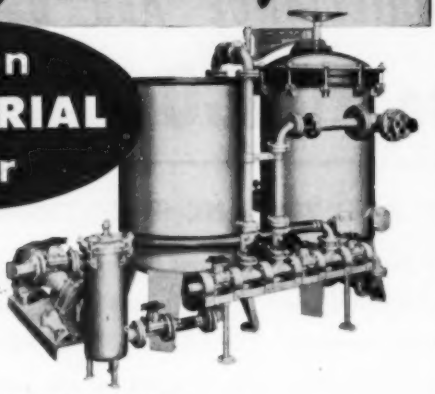
# For Any Plating Solution *Any Quantity*

use an **INDUSTRIAL** Filter



*100 to 15,000 gallons per hour. Portable and stationary models. Standard or special filtration systems engineered to meet unusual requirements.*

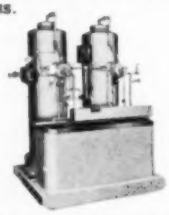
## You save many ways . . .

Here's how Industrial filters keep down the cost of plating jobs—The flow rates of Industrial filters are based on the actual plating solutions involved. You know the capacity you get. In the filtration of plating solutions there is more than just the filter. With Industrial you get an adequate filter with slurry tank, motor driven pump, valves and fittings in a complete package with one, undivided, experienced responsibility—with space requirements at a minimum.

The labor, down time, and the inconveniences of cleaning, replacing the filter media, and reassembling the filter for every new filter cycle—all are eliminated by the Industrial Air-Wash Cleaning Method available for all models. It is necessary to remove the cover only when new filter cloths are installed. With Industrial filters, a clarified plating solution is always assured.

The engineering, design, and construction of Industrial filters have proved out in long service and low maintenance costs. Industrial has the experience and is large enough to handle your filter requirements. Since 1927 filters and filtration systems have been an important part of our business.

**INDUSTRIAL Water Demineralizers**



*A Two-Bed INDUSTRIAL Water Demineralizer. Standard two-and four-bed units available with capacities of 200 to 1000 gph. Special units of any capacity engineered to requirements.*

*for* **No stains after hot rinse. No unwanted precipitates in solutions.**

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FILTERS Pressure Type · PUMPS Centrifugal · CORROSION TESTING APPARATUS Salt Fog • Humidity

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RUBBER DIVISION Vulcanized Linings • Molded Products · WATER DEMINERALIZERS


# *Branch News*

### CINCINNATI BRANCH

The Branch journeyed South for its annual summer picnic on June 22, when some 40 members took to the road to enjoy themselves to the hilt in the Bluegrass State of Kentucky. Although it was a long and arduous trip, made doubly difficult by faulty or missing roadsigns, the travellers were rewarded with excellent opportunities for recreation once they reached their destination in Latonia's Shady Shores. Baseball, of course, was the main bill of fare, with the Millers (President Robert D.) and the Wises (Secretary Charles) tangling in a hard-fought battle, which went all of three innings, leaving the participants pretty well exhausted from their labors. The Millers claimed victory by a 9-to-8 score, but the Wises stoutly maintained it was an 8-to-8 tie game.

In addition, the golf driving range, shuffleboard, and cards kept one and all busy but not too busy to enjoy an excellent picnic supper.

That the entire affair was a huge success can easily be attested to by the fact that the picnic committee, in the personages of Ray Barry and Stewart Chipman, was only represented by half of its personnel half of the time.

Charles Wise, *Secretary*

### COLUMBUS BRANCH

Installation of officers took place at a dinner meeting in the Emerald Room of Fort Hayes Hotel on May 4, with A. E. S. President William Neill in charge. Mr. Ezra Blount, Editor of Products Finishing, was the after-dinner speaker.

The new officers are:

*President*—J. Edwin Bride
*First Vice-President*—Dr. Nathan L. Koslin
*Second Vice-President*—Wilbur Hespenheide
*Secretary-Treasurer*—John Soderberg
*Librarian*—Richard Jager
*Board of Managers*—John Beach, William Balzer, Walter W. Denney
Nathan L. Koslin, *Secretary-Treasurer*

### MELBOURNE BRANCH

Thirty-three members and visitors braved Melbourne's coldest day in 50 years to attend the 63rd regular meeting of the Branch on July 19. A film rewarded those who attended with an insight into the production of nickel and copper anodes. It must have been a very old film, as it showed nickel in great abundance.

Committeeman Harold Merton introduced the lecturer, Jim Parker, whose subject was "Anodes". As soon as trouble is encountered, most platers analyze their solutions, and if composition is satisfac-

Lead
Tin
Copper
Cadmium
Iron
Nickel

# B&A FLUOBORATE PLATING SOLUTIONS GIVE YOU *These Big ADVANTAGES*

The standout performance of B&A Metal Fluoborates in lead, tin, iron, copper, cadmium and nickel plating is enabling platers to increase production while effecting real savings in critical metals.

In addition, B&A Fluoborates provide a host of important advantages not available in other plating agents. *In alloy plating*, for example, they offer the only fast efficient way to plate lead-tin and lead-tin-copper alloys—simultaneously—with the ratios easily controlled. *In cadmium plating*, outstanding results are obtained *without* the hydrogen embrittlement common to other methods. *In lead and tin plating*, they produce coatings of excellent solderability—particularly after aging.

Yes, all these advantages *and more* are offered by B&A Metal Fluoborates. Learn more about them without delay. For operating data, experimental or commercial quantities—or for free technical consultation—write or phone the nearest B&A office listed below.

B&A Fluoborate solutions offer an unusual combination of advantages for increased efficiency, including:

1. **No mixing or dissolving necessary . . . supplied in concentrated solution form.**
2. **Easier bath preparation**
3. **Stability of bath composition**
4. **Ease of control**
5. **Practically 100% anode and cathode efficiencies**
6. **High conductivity**
7. **Good covering power**
8. **Fine-grained deposits of good color**
9. **Faster, high-speed operation**

**AND MANY MORE—**

In addition to these general operating advantages, each fluoborate bath has a number of special advantages for its particular applications.

REAGENTS
B&A
STANDARDS OF PURITY
FINE CHEMICALS

## BAKER & ADAMSON *Fine Chemicals*

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tory, they look for some other cause of trouble instead of examining the condition of their anodes in the first place. Mr. Parker explained how to recognize and correct difficulties emanating from the anodes, and without delving too deeply into theory, described the behaviour, routine maintenance, and advantages and disadvantages of each type of anode likely to be encountered in copper, nickel, chromium, tin, zinc, and cadmium plating. Many worthwhile hints, such as on effects and remedies for polarization and reduction of trivalent chromium, were included in the talk, which was followed by questions as to the purity required for anodes and the effect of iron in cyanide solutions.

Anch Thompson, in moving a vote of thanks to the speaker pointed out how fortunate the Branch was in having among its members a number of speakers capable and willing to give such interesting lectures as this.

Rowland H. Keller,
*Honorary Secretary*

### PHILADELPHIA BRANCH

The regular June meeting, preceded by a dinner, was held at Mosebach's Restaurant on June 22, with 22 attending the dinner, and four coming in later for the meeting.

The main speaker, Mr. Roy Benjamin of Maas & Waldstein Company, was introduced by Librarian Boerckel. He spoke on "Substitute Organic Finishes for Plating During the National Emergency", describing various types of air-drying and baking finishes and their basic applications. He exhibited samples of the finish obtained on paper with "Plextone", a multi-colored, air-drying enamel, the colors of which maintain their separate identities in the container even after long periods of storage. As this material contains 5 per cent water, its present applications are limited to nonmetallic materials or primed metal surfaces. Also shown were samples of colored transparent coatings, used over steel and zinc to simulate plated appearance: these coatings are also suitable on aluminum.

The next speaker was Mr. Edwin F. Ottens, First Vice-President of the Branch, who gave a brief talk on "Substitute Plating During the National Emergency". Of the nine metals useful to platers, only two, lead and zinc, were in reasonable supply. The applications for lead were limited due to its unattractive appearance, softness, and toxicity. The use of conversion coatings on zinc and their limitations was discussed, as were the coating of plastic objects by evaporation of metals with further protection supplied by a clear organic finish; oxide coatings with subsequent corrosion-inhabiting coatings; the possible use of phosphate coatings augmented with rust protecting coatings. A spirited discussion followed from the floor, showing the interest aroused by this all-important topic.

President Al Pope announced the appointments to the 1951 Banquet and Educational Session Committee.

Motions were passed that each delegate to the 1951 Convention receive $110 for expenses; that the Branch support a cost-of-living increase for Supreme Society clerical personnel depending on individual ability and length of service; that the Delegates be uninstructed as to the hiring of an A. E. S. Assistant Executive Secretary, giving consideration to the length of time the assistant is expected to serve as such; that the Delegates vote to limit the salaries of the Executive Secretary and the Editor of Plating to present salaries stated in the 1951–1952 budget, page 3, item 14; and that the Delegates do not vote for any increase in dues other than that necessary to carry out previous motions passed and for a $1.00 increase in dues for the Research Fund.

A motion was passed that the Branch secretary's salary be paid on the basis of $1.00 per year per member for whom per capita tax is paid annually. It was also decided that Branch Past Presidents be given a past president's pin by the Branch.

I. Wm. Marcovitch, *Secretary*

### ROCHESTER BRANCH

The meetings of the newly elected officers and Board of Managers were inaugurated on June 18 with an excellent dinner at the "40" over "8" Club. After the dinner, the business meeting was called to consider the fall program, and ways and means of increasing the membership and of perpetuating the interest of the present members.

The new meeting place, for the September meeting, will be the "40" over "8"

Start Clean...
Stay Clean!

Young "Six-Gun" is all scrubbed and tubbed—and he's making sure he *stays* clean! He sets a good example for the plater because it's wasteful and expensive to prepare work for plating only to put the clean metal into a bath of questionable purity.

*Start* clean . . . *stay* clean! Red Label Darco S-51 adsorbs in its pores the impurities that cause trouble in plating baths . . . takes them out of the bath before they can be deposited on the freshly cleaned surface of your work.

Red Label Darco helps you save on scarce anode metals . . . helps you do a better job with thinner deposits . . . minimizes rejects.

With clean metal... keep the Bath Clean

Red Label Darco S-51 is especially treated for use in plating—the only activated carbon that meets the benzol-mercury test! It is especially easy to handle . . . easy to wet . . . easy to make into a slurry. Place your order for Red Label Darco today. Don't accept substitutes because practically all suppliers carry Darco in stock.

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ATLAS POWDER COMPANY
Darco General Sales Offices
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Club. Identification tags will be made for all members and worn at the meeting so they may become acquainted with one another. In order to increase social contacts, the September meeting will include refreshments and buffet lunch.

JOHN Q. ADAMS and EDWIN M. WALLIN will investigate the use of movies as an educational medium. The Secretary will obtain information about the possibility of a joint meeting with the American Society for Metals and the Industrial Organic Finisher. A joint meeting with the Buffalo and Syracuse Branches will be taken up at the September meeting. One meeting will be devoted to question-and-answer program with a local board of experts.

A letter will be sent to the managements of local plants informing them of the work of the American Electroplaters' Society. The members will be notified of the meeting by a form letter. More advertising of the meetings in local paper and radio will generate more interest in the Society.

The Delegates to the Buffalo Convention were instructed to take up the question, "The Soliciting of Membership of Sustaining Members should be taken over by the National Society".

Mr. C. F. Nixon's talk to Chicago Branch on per capita tax was considered, and the Delegates were instructed to vote *no* to the increase in per capita tax, unless detailed break-down of operating expense justified an increase.

Two applications for membership were approved.

CHARLES B. FIDEOR, *Secretary*

## ROCKFORD BRANCH

The June meeting took the form of a picnic at the SM & SF picnic grounds with an attendance of 68 people. A complete dinner of baked ham, baked beans, potato salad, cheese and beverages was served at 6:00 P. M.

"Senator" CRAWFORD of the Chrome Rite Corporation of Chicago showed his own colored movies and lectured on "Wild Game Hunting and Fishing". The "Senator" had the group on the edge of their seats with thrills and laughter. The film on Tarpon Fishing was so well done that a large producer of glass fishing rods had purchased the film. The "Senator" is thinking that he might have found a way to get out of the plating business. Perhaps we can follow his footsteps.

PRESIDENT DALE CHAPMAN appointed DAVE STOCKTON Branch Research Committee Chairman.

Many out-of-town guests were present, and a good time was had by all.

KEN KIESELBURG, *Secretary-Treasurer*

## SAN FRANCISCO BRANCH

F. W. HUNTINGTON opened the meeting on April 19 with a current report on NPA Directives.

J. R. PATTENGER gave a report on meeting before Congressman Shelley, House Sub-Committee on small business, at which he pointed out that DO-97 was not acceptable to secure nickel. The committee promised to cooperate with NPA in an effort to improve this situation.

The following officers will serve the Branch during the next fiscal year:

*President*—GEORGE COOK
*First Vice-President*—STUART PANKEY
*Second Vice-President*—LOUIS TOMPKINS
*Secretary-Treasurer*—HORACE SMITH
*Librarian*—F. W. HUNTINGTON
*Board of Managers*—J. R. PATTENGER, C. R. OWENS, JACK HITE
J. R. PATTENGER, *Acting Secretary*

## SAN FRANCISCO BRANCH

The usual business session was dispensed with at the meeting on May 17.

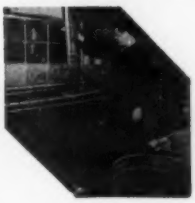
VICE-PRESIDENT S. W. PANKEY suggested a July meeting in Alameda and was appointed to arrange details. E. M. ALEXANDER was appointed to investigate the possibility of shop owners contributing toward refreshment at the July educational session.

The speaker of the evening was MR. ELBURN MARCUM of duPont, who gave a very informative and well received talk on "Bright Brass Plating".

A guest from the Los Angeles Branch, MR. G. J. EXTALE, of the General Electric Company, Ontario, Calif., gave a talk on the plating of electric irons in his plant. A lively discussion followed on the merits of various metals as a base for chromium plating.

G. H. COOK, *President*


PERMAG



Non-Electrolytic
CLEANING
COMPOUND

PERMAG Quality is proved by Platers' Acceptance for 28 years

*For Your Technical and Purchasing Index File*

Non-Electrolytic
PERMAG Cleaning Compounds

PURPOSE
a. Used prior to electrolytic cleaning.
b. Used when electrolytic cleaning is not required.

REQUIREMENTS
a. To remove bulk of soil.
b. To lengthen life of electrolytic cleaning compound.
c. To clean work properly for next step.

CONSIDERATIONS FOR SELECTION
a. Adaptability to processing.
b. Requirements for installation.
c. Desirable material characteristics.

First of a series for Card Index Files on cleaning metals with time-tested PERMAG Compounds, prior to electroplating.

MAGNUSON PRODUCTS CORP.
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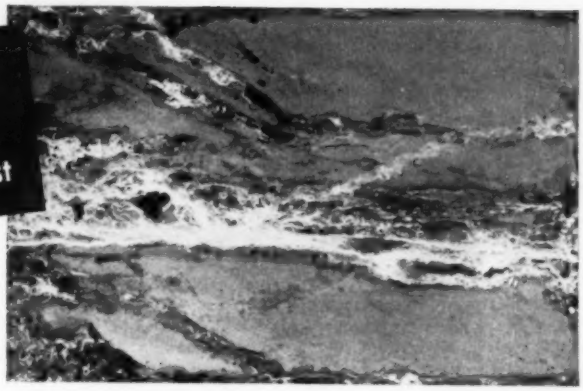
# PICTURES WORTH 1000 WORDS

## PROMAT STABILIZED ZINC
after 200 hour salt spray test

*THE TEST:* Promat additive C-42 in zinc plating bath *followed by Promat 2080* (20-1 dilution) in a simple secondary dip. Exposed 200 hours in salt spray.

*RESULTS:* No white corrosion or red rust. Only a slight stain apparent.

## UNTREATED ZINC PLATING
after 200 hour salt spray test



*THE TEST:* Promat additive C-42 in plating bath followed by 1/2% Nitric Acid dip. Exposed 200 hours in salt spray.

*RESULTS:* White corrosion apparent at 19 hours, heavy at 200 hours. No red rust.

HERE is proof that Promat stabilized zinc answers the need for protective finishes on both civilian and military items. Promat 2080 is an O.D. type finish. It can be used from 20 to 80 concentrate depending on color and amount of chrome deposit required. Promat 2080 finish complies with: U. S. Army Specification 57-0-2c, Amendment 2; Navy Ordnance Specification 1374; Air Force Specification An-P-32, Paragraph C-2d; and Signal Corps Specification 72-53, Paragraph E-2a (4). In addition to providing excellent corrosion resistance, low cost Promat secondary treatments make the surface paintable as well. Bright, semi-bright, dull and olive drab finishes are available.

It will pay you to find out about new things from Promat—preparation, plating and secondary treatment that give zinc new importance.

**SEND FOR THIS FOLDER**
*describing Promat products for better zinc plating.*

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Chicago, Illinois

# *Membership Report of the A. E. S.*

### Elections

**DALLAS-FORT WORTH:** S. A. Bergman, J. J. Brock, A. Mellor, L. V. Schowalter, L. M. Stewart, E. C. Tanner

**HOUSTON:** C. R. Feick, H. T. Hancock, W. F. Herberg, Jr., B. D. Kearn, R. H. LeRoy, E. A. Schumacher

**LANCASTER:** H. O. Woolley, Jr.

**MELBOURNE:** R. J. Graham, P. A. Jacks, G. R. Lunn

**PITTSBURGH:** E. Leopardi

**ROCHESTER:** F. P. Ciambrone, H. A. Weaver

**SAGINAW VALLEY:** G. Fitzgerald, R. A. Marshall, E. Starkel

**SAN FRANCISCO:** J. M. Crow

**SYDNEY:** S. R. Bennett

**SYRACUSE:** R. H. Hill, C. A. Valentine

**WATERBURY:** L. B. Foster

**MEMBERSHIP-AT-LARGE:** D. J. Bouckley, C. G. Ghanshamdas, I. H. Schram, Jr.

### Reinstatements

**SYDNEY:** G. Brown, J. Godfrey, J. Lean, L. A. Smith, S. S. Cook, F. Heard, A. M. Reeves, A. H. Talbot

### Transfers

L. M. Rasmussen to Bridgeport; C. Chalfant from Dayton; C. Amore from Dayton; W. Fowler from Grand Rapids; G. Oetterman incomplete transfer to Houston; C. A. Sayers from St. Joseph Valley to Indianapolis; J. A. Jacks from Saginaw Valley

### Resignations

**BRIDGEPORT:** F. H. Duncombe, J. W. Lewis

**DAYTON:** E. Hassell

**MELBOURNE:** J. W. Benge

**PHILADELPHIA:** H. D. Strunk

**PITTSBURGH:** D. Berman

**SAGINAW VALLEY:** F. A. Aston

**SAN FRANCISCO:** F. Browning, R. S. Novello

### Suspensions

**CINCINNATI:** R. Lindenhayn, Jr., R. B. Willett

**PITTSBURGH:** E. T. Busch

**SPRINGFIELD:** J. Laing, I. D. Niles, K. J. Valego

## Membership Competition

| Branch | Membership Apr. 1, 1951* | New Members | Net Change in Membership | Per Cent Net Change |
|---|---|---|---|---|
| **First Group** | | | | |
| Melbourne‡ | 126 | 11 | + 9 | + 7.1 |
| Chicago | 409 | 29 | +26½ | + 6.5 |
| New York | 279 | 11 | +12½ | + 4.5 |
| Boston | 151 | 7 | + 6 | + 4.0 |
| Cleveland | 205 | 8 | + 7 | + 3.4 |
| Milwaukee | 143 | 6 | + 4 | + 2.7 |
| Los Angeles | 211 | 7 | + 5 | + 2.4 |
| Philadelphia | 201 | 6 | + 4 | + 2.0 |
| Bridgeport | 152 | 6 | + 2½ | + 1.6 |
| Waterbury | 126 | 3 | + 2 | + 1.6 |
| Detroit | 492 | 9 | + 6½ | + 1.3 |
| Newark | 239 | 3 | + ½ | + 0.2 |
| Hartford | 137 | 3 | ..... | ..... |
| Pittsburgh | 132 | 1 | ..... | ..... |
| Grand Rapids† | 164 | .. | − 1 | − 0.6 |
| **Second Group** | | | | |
| Syracuse | 85 | 8 | + 9 | +10.6 |
| Rockford | 67 | 6 | + 6 | + 9.0 |
| Buffalo | 85 | 6 | + 5 | + 5.9 |
| Baltimore-Washington | 87 | 5 | + 4½ | + 5.2 |
| Rochester | 88 | 2 | + 2 | + 2.3 |
| Indianapolis | 92 | .. | + 1½ | + 1.6 |
| St. Joseph Valley | 71 | 1 | + ½ | + 0.7 |
| St. Louis | 105 | .. | ..... | ..... |
| New Haven | 108 | .. | ..... | ..... |
| Toronto | 121 | .. | ..... | ..... |
| Providence-Attleboro | 100 | .. | − 1 | − 1.0 |
| Dayton | 82 | .. | − 2 | − 2.4 |
| Cincinnati | 88 | 1 | − 3½ | − 4.0 |
| Montreal | 77 | 1 | − 4 | − 5.2 |
| Sydney | 93 | 2 | − 8 | − 8.6 |
| **Third Group** | | | | |
| Dallas-Fort Worth | 31 | 11 | +11 | +35.5 |
| Houston | 25 | 6 | + 7 | +28.0 |
| Southeastern | 48 | 2 | + 2 | + 4.2 |
| Saginaw Valley | 57 | 3 | + 1½ | + 2.6 |
| Lancaster | 60 | 2 | + 1 | + 1.7 |
| San Francisco | 65 | 4 | ..... | ..... |
| Louisville | 23 | .. | ..... | ..... |
| Hamilton | 25 | .. | ..... | ..... |
| Jackson-Lansing | 52 | .. | ..... | ..... |
| Columbus | 54 | .. | ..... | ..... |
| Twin City | 66 | .. | − 1 | − 1.5 |
| Springfield | 54 | 2 | − 1 | − 1.9 |
| Toledo | 45 | .. | − 1 | − 2.2 |
| Allentown-Reading§ | 42 | .. | − 3 | − 7.1 |
| Adelaide | 65 | 6 | − 6 | − 9.2 |
| Western Ontario | 23 | 4 | − 6 | −26.1 |
| **Outside Competition** | | | | |
| At Large | 120 | 8 | + 8 | ..... |
| In Transfer | 16 | .. | + 8 | ..... |
| **Total A. E. S.** | 5,387 | 190 | +115 | + 2.1 |

Active Membership, August 1, 1951 ..... 5,502

*Subject to correction. †, ‡, §Winners in first, second and third group, respectively, of 1950–1951 membership competition.

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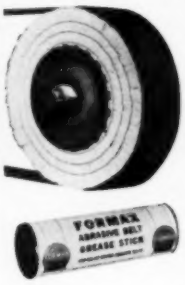


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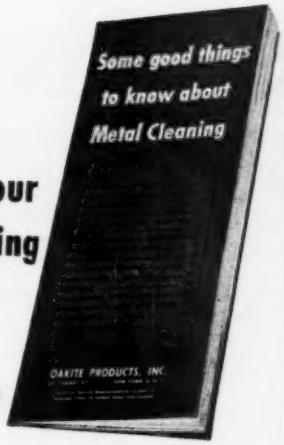


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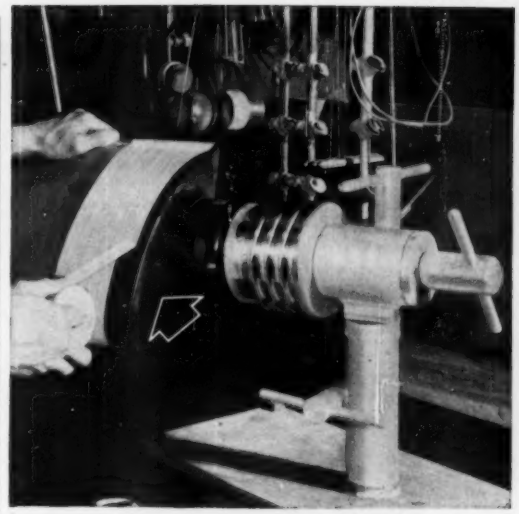

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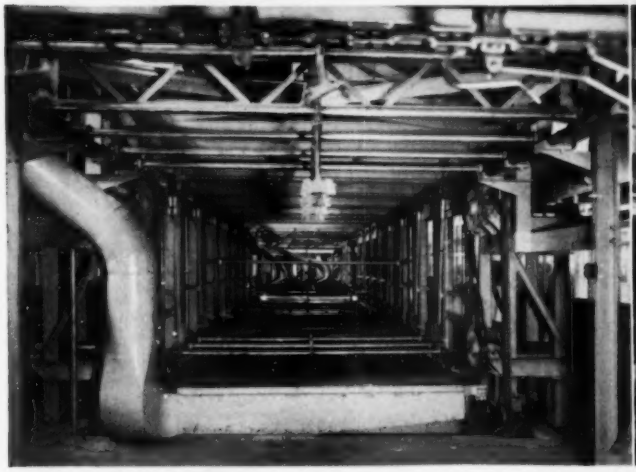

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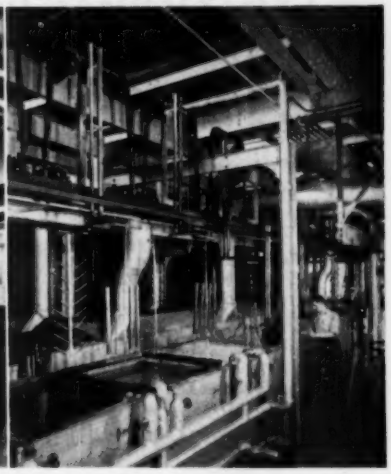

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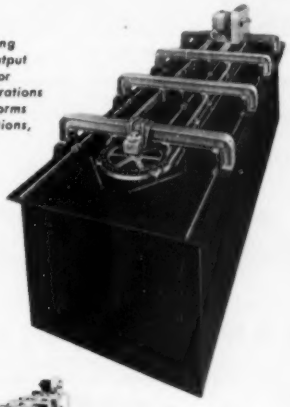

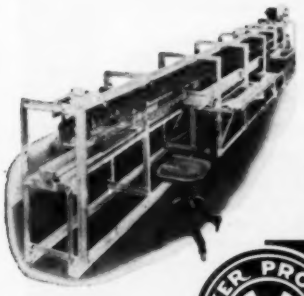

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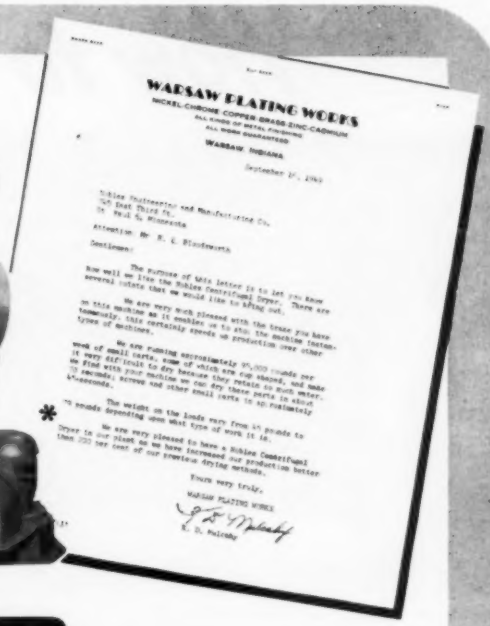

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AMERICAN CHEMICAL SOCIETY Diamond Jubilee Meeting in New York City on September 3–7.

6TH ANNUAL INSTRUMENT CONFERENCE AND EXHIBIT, sponsored by the Instrument Society of America, in Sam Houston Coliseum, Houston, Texas, on September 10–14.

THE ELECTROCHEMICAL SOCIETY Fall Conference in Statler Hotel, Detroit, Mich., on October 10–13.

3RD ANNUAL METAL SHOW at Michigan State Fair Grounds, Detroit, Mich., on October 15–19.

INTERNATIONAL ASSOCIATION OF ELECTROTYPERS AND STEREOTYPERS 54th Annual Convention in Hotel Kenmore, Boston, Mass., on October 23–25.

24TH INTERNATIONAL CONGRESS FOR INDUSTRIAL CHEMISTRY AND 1ST CHEMICAL EXHIBITION in Paris, France, on November 25–December 1.

3RD INDUSTRIAL FINISHING EXPOSITION AND 39TH ANNUAL CONVENTION OF THE AMERICAN ELECTROPLATERS' SOCIETY in International Amphitheatre, Chicago, on June 16–20, 1952.

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## MacDermid, Incorporated, Opens Ferndale Plant

FERNDALE, MICH. — MacDermid Incorporated of Waterbury, Conn., recently opened a new plant at 810 Rosewood Ave., Ferndale for the manufacture of chemicals for the MacDermid Bright Copper plating process, alkaline and solvent cleaning compounds, as well as other specialty chemical products for the metal finishing industry.

The new facilities will enable them to offer improved service to meet the increasing demand for their products in this area. The plant will manufacture the entire list of MacDermid products and will contain a complete chemical laboratory. This along with new manufacturing facilities . . . .

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. . . the complete background of knowledge and experience in every aspect of plating and polishing.

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| METAL TO BE CLEANED | SOIL TO REMOVE | IN SOAK CLEANING | IN ELECTROCLEANING | COMMENTS |
|---|---|---|---|---|
| IRON & STEEL | LIGHT COATS OF OILS & GREASES | MAT. 2W | MAT. 30W | |
| IRON & STEEL | LIGHT COATS OF OILS & GREASES | | MAT. 2 | NON-FOAMING |
| IRON & STEEL | LIGHT OR HEAVY COATS OF OILS & GREASES | MAT. 30 | | FOR POWER SPRAY-TYPE WASHING MACHINES |
| IRON & STEEL | HEAVY COATS OF OILS & GREASES | MAT. 40W | MAT. 45W | |
| IRON & STEEL | HEAVY COATS OF OILS & GREASES | MAT. 40F | | ROSIN SOAP TYPE |
| IRON & STEEL | HEAVY COATS OF OILS & GREASES | | MAT. 40 | NON-FOAMING |
| IRON & STEEL | HEAVY COATS OF OILS & GREASES | | MAT. 51W | REVERSE AND DIRECT CURRENT |
| IRON & STEEL | HEAVY COATS OF OILS & GREASES | | MAT. 65-1M | REVERSE CURRENT ONLY |
| COPPER, BRASS & BRONZE | BUFFING COMPOSITIONS, LIGHT OILS | MAT. 2W | MAT. 30W | |
| COPPER, BRASS & BRONZE | BUFFING COMPOSITIONS, LIGHT OILS | | MAT. 20W | NON-TARNISHING |
| DIE CASTINGS ZINC BASE | BUFFING COMPOSITIONS, LIGHT OILS | MAT. 20W | MAT. 30W | REVERSE CURRENT CLEANING |
| LEAD BASE CASTINGS | BUFFING COMPOSITIONS, LIGHT OILS | MAT. SOLVENT #1 | | |
| ALUMINUM ALLOYS | BUFFING COMPOSITIONS, LIGHT OILS | MAT. 20W | MAT. 20W | SHORT DIRECT CURRENT CLEANING, NON-ETCHING |
| ALUMINUM ALLOYS | BUFFING COMPOSITIONS, LIGHT OILS | MAT. 25 | | ETCHING |
| MAGNESIUM BASE CASTINGS | BUFFING COMPOSITIONS, LIGHT OILS | MAT. 50W | MAT. 50W | |
| GENERAL PURPOSE STEEL, BRASS, DIE CASTINGS | RUN OF THE SHOP | MAT. 30W | MAT. 30W | DO NOT USE ON ALUMINUM |

**The cleaners listed and briefly described above are the H-VW-M Cleaners most generally used by the industry. They are, however, only a part of H-VW-M's service in supplying the plating and polishing industry with essential cleaner requirements. The complete facilities of H-VW-M's modern laboratory are always available for the formulation of cleaners to meet specialized, individual needs.**

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**Bulletin C-106 gives details on the standard line of H-VW-M Cleaners.**

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